HIGHLIGHTS

REVISION NO. 33 Jun 01/10

Pages which have been revised are outlined below, together with the Highlights of the Revision

CH/SE/SU C PAGES	REASON FOR CHANGE	EFFECTIVITY
CHAPTER 70		
L.E.P. 1- 2	Revised to Reflect this revision indicating new,revised, and/or deleted pages	
T. OF C. 1	Revised to reflect this revision	
70-00-00	Minor additions and amplification	
210, 216-218, 224, 228, 231-232, 240, 246, 252, 263, 265-266, 268-A241	REVISED TORQUE CHECK FOR RE-USE OF SELF-LOCKING NUTS. ADDED MATERIALS NΔ C02-053 AND C02-079. REVISED CONSUMABLE LOCATION REFERENCES. ADDED MATERIALS NΔ C01-008 AND C01-015. Layout improved	

CHAPTER 70

STD. PRACTICES-ENGINE

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively
Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary

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OF TEMP.			
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CHAPTER 70

STD. PRACTICES-ENGINE

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1. General Information

A. General

(1) This chapter contains Standard Practices applicable to operation tasks performed on the basic engine at line level of maintenance. For operator convenience, the Standard Practices are repeated in a limited and condensed format, providing a consolidated source of detailed information.
This standardization eliminates the needless repetition of processes that are frequently used in the maintenance and repair of jet engine parts.

(2) Standard Practices described in this chapter and used at this level of maintenance are identical to those similar procedures contained in the General Electric Standard Practices Manual, except for the limited format and identification of the 6-digit ATA numbering system.

B. Definition and Formats

A standard practice is a single process that is required for the maintenance of numerous parts. Each process has a defined area of application for accomplishing a specific task.

(1) The General data for each category defines the particular characteristics of the category processes and non-specific data to guide maintenance personnel in using the processes.

(2) The Process Standard Practices data defines the general information relating to the process and the detailed instructions regarding the equipment, method, and quality assurance.

(3) The Test Practices and Process Control data provides the definition of the evaluation or verification of the quality of the process employed on samples of an identical or equivalent nature to the engine hardware. It also specifies the limits required for acceptability criteria, and references a number of consummable products and compounds which are defined in the Consumable Products List.

C. Safety

In the Process Standard Practices where risks exist, proper notice is inserted in the text by **WARNING** or **CAUTION** note.

D. Weld Repairs on Engine

WARNING : THE AIRCRAFT AND ENGINE MANUFACTURERS RECOMMEND THAT YOU DO NOT WELD ENGINE COMPONENTS WHEN THE ENGINE IS INSTALLED ON THE AIRFRAME.
ALL THE WELD REPAIRS GIVEN BY THE ENGINE MANUFACTURER ARE FOR ENGINES OR COMPONENTS IN A WORKSHOP.
THERE IS A FIRE RISK IF YOU WELD ON AN INSTALLED ENGINE BECAUSE OF THE FLAMMABLE LIQUIDS IN THIS AREA.

E. Definition of Terms

The following terms are used to describe/define defects.

TERM	DEFINITION	ASSOCIATED TERMS
Blister	A raised portion of a surface caused by separation of the outer layers of the parent material or of a coating applied to it.	Bubble Flaking Oxide Formation Peeling Scale Slag inclusion (weld)
Brinelling	Indention of the surface by concentrated loads or impact	peening hammering
Brittle	A change in the elasticity or resilience of the parent material usually caused by aging, extreme cold, chemical action, or cold-working	cold worked hard (like an old O-ring)
Buckle	A large-scale deformation of the original contour of a part, usually caused by pressure or impact from a foreign object, structural stresses, excessive localized heating, high-pressure differentials, or any combinations of these.	ballooning bend bulge crease curl dent (not to be confused with small-area defect in heavy material). depression distortion elongation fold indentation kink protusion (hollow) rupture (result of excessive buckling uneven warpage wrinkle
Burn	A rapid, destructive, oxidizing action, usually caused by higher temperatures than the parent material can with-stand. Change in color appearance often indicates this condition	Burn out (missing piece) erosion corrosion guttered heat-check heat deterioration hole (burn) Hot spot verheated oxidation

TERM	DEFINITION	ASSOCIATED TERMS
Burnishing	Smoothing of a metal surface by mechanical action, but without a loss of material. Generally found on plain bearing surface. Surface discoloration is sometimes visible around the outer edges. Normal burnishing from operational service is not detrimental if the coverage approximates the carrying load and there is no evidence of burns,	rub wear
Burr	A rough edge or a sharp protrusion on the edge or surface of the parent material.	
Chafing	See "Gall" or "Scratch"	
Chip	A breaking away of the edge of the parent material, usually caused by heavy impact form a foreign object.	Break Nick (similar to Chip, but no parent material is removed.) Notched Spalling (usually a broken-away flat surface).
Cold shut	A forging or casting defect resulting from metal flowing into an area from two directions, thereby forming a discontinuity at the meeting line.	Seam
Corrosion	A mass of small pits which cumulatively create a large, shallow cavity (usually rough) in the surface of the parent material.	Pit
Crack	A parting or discontinuity in the parent material.	Break old shut (castings) Crater (castings) Fatigue damage Fissure Fracture Lap (forgings) Rupture Seam Separation Slit Tear
Crack	A parting of parent metal, or of the	

TERM	DEFINITION	ASSOCIATED TERMS
(Fabrications)	metal in a welded zone. Parent metal crack limits include all cracks in the parent metal beyond the heat-affected zone, as measured 1/8 inch from the weld fusion line. Weld crack limits include all cracks in the heat-affected zone.	
Crazing	A mesh of minute hairline cracks found in glazed or baked-on coated surfaces, generally caused by temperature change or by deformation of parent metal. Cracks do not penetrate into parent metal.	
Creep	Gradual continuous distortion or plastic flow under constant stress.	
Deformation	Any alteration or change of shape dimension or configuration resulting from stress or damage.	bend creep distortion
Dent	A completely smooth surface depression caused by pressure or impact from a smooth, rounded foreign object. The parent material is displaced, but none is separated.	peen
Deviation	Any condition that causes a part to differ from the manufacturer's blueprint.	Damage Defect Flaw Imperfection Irregularity
Discontinuity	An interruption in the normal physical structure or configuration of a part.	crack Seam Cold shut Lap
Distortion	Any twisting, bending, or permanent strain that result in misalignment or change of shape.	Bend Deformation
Erosion	Gradual wearing away of a surface caused by a fluid (gas or liquid) flowing over the surface. Wear is generally caused by fine particles of foreign material entrained in hot engine gases flowing at a high velocity.	

TERM	DEFINITION	ASSOCIATED TERMS
Fatigue	The progressive fracture of a material under cyclic stress loading.	Crystallization Fretting Flaking
Flaking	See "Spalling"	
Fretting	Wearing away by low-amplitude rubbing against another metal (generally associated with press fit or close-fitting parts).	Wear Galling
Galling	A defect caused by the movement of 2 surfaces in contact with each other. In most cases, an accumulation of foreign material is deposited on the parent material.	Pickup
Gouge	A wide, rough scratch or group of scratches, usually with one or more sharply incised corners, and frequently accompanied by deformation or removal of parent material.	
Groove	A long, narrow, continuous depression caused by pressure of a moving surface in contact with the parent material	If depression is shallow and smooth, see "wear" if depression is sharp see "Scratch"
High spots	Local distortions	Blister Buckle Bubble Out-of-round
High metal	Displaced metal adjacent to a defect such as a scratch, nick or gouge, which is raised above the surrounding surface.	Burr
Imbalance	The state of being out-of balance. Unequal distribution of weight about the axis of rotation, which usually results in vibration.	
Inclusion	Foreign material embedded in metal during solidification, or formed by subsequent reaction of the solid metal.	

TERM	DEFINITION	ASSOCIATED TERMS
Indication	The visible evidence that a material defect exists, even though the defect itself may not be visible to the naked eye.	
Looseness	Abnormal movement of a part, or insufficient securing of a part	Backed out Excessive play Excessive back-lash Insufficient torque Shaky Sloppy bottomed Unpinned Unwired
Misalignement	A mismatching or malformation of any part which either prevents perfect assembly or results in faulty operation and/or ultimate failure.	Eccentric Out-of-round Out-of-square Mismatched Unmatched
Nick	A surface impression with sharp corners or bottom, usually caused by pressure or impact from a sharp-edged object. The parent material is displaced, but usually none is separated.	Chip Dent Notch
No Apparent Depth	Term used to describe surface defects that can be seen but not felt with fingernail or scriberpoint.	
Noise	An abnormal sound involving moving parts, usually an increase in volume or a change of pitch.	Bumps (sound) Chatters Clicks Grates (usually gears) Grinds - Hums Rattles - Rubs Scrapes (sound) Screeches - Thumps Whistles
Obstruction	Prevention of free flow of a fluid (air oil, fuel, water) because of foreign material in the flow-path or malformation of the part.	Clogged Contaminated Plugged Restricted
Oil-canning (snapping	Snapping or popping displacement of sheet metal when restrained at	Buckling

TERM	DEFINITION	ASSOCIATED TERMS
action)	its edges like a diaphragm, wall, or bottom of an oil can.	
Parent Metal	All material in a single part except the weld, braze filler, or heat-affected zone (within 1/8 inch of the fusion line).	
Pickup	Transfer of one material into or onto the surface of another in contact with it, usually as a result of friction-heating.	Burr Gall Imbedment Inlcusion Pile-up Protrusion Metallization
Pinched	Distortion of one or more surfaces of the parent material, caused by pressure	Bound Compressed Flattened Seized Smashed (without separation into pieces) Squashed Squeezed
Pinholes	Very small pits or holes caused by the evolution of gas from a metal during solidification or after chemical treatment.	Porosity pits
Pit	A minute depression or cavity having no sharp, highstress corners in the surface of the material. Pits are usually caused by chemical reaction (rusting, chemical corrosion).	Corrosion Crater Electrolytic Cavity Inclusion Perforation Pinholes Pock-marked
Porosity	Areas containing numerous pits or pinholes	pit pinholes
Rub	A surface depression or displacement caused by two surfaces moving while in contact each other	If impression is shallow and smooth, see "Wear". If impression is sharp, see "Scratch"
Scale	A layer of metallic oxides formed by chemical action of oxygen on the ex-	Burn

TERM	DEFINITION	ASSOCIATED TERMS
	posed surface of the metal, usually while hot.	
Scratch	A long, narrow, sharpcornered impression caused by the movement of a sharp object across the surface of the parent material.	Abrasion Chafe Furrow Groove Score
Seizure	A welding or binding of surfaces which prevent further movement.	Bound up Frozen Tight Wedged Welded (without external heating)
Spalling	Cracking off or flaking off of small particles of metal from the surface, usually in thin layers or localized spots.	Flaxing Fretting Galling
Unbalance	The act of putting a balanced component out of balance. Usually "imbalance" is meant.	
Varnish film	A hard surface-film of partially carbonized hydrocarbon, such as oil, which is built up when the part is heated to or above the break-down-point of the fluid. nent out of balance. Usually "imba-	Banded Discolored Oxidized Stained
Wear	Relatively slow removal of parent material in the process of operation (not always visible to the naked eye).	Abrasion Attrition Brinnelled Chafed Chattering Erosion Fraying Fretting Friction Galling Glazing Groove Interference Oxidation Roughness Rubbed Scarfed

TERM	DEFINITION	ASSOCIATED TERMS
		Scuffed
		Uneven
		Weak

F. Abbreviations

The following abbreviations have been used for terms that appear within the manual.

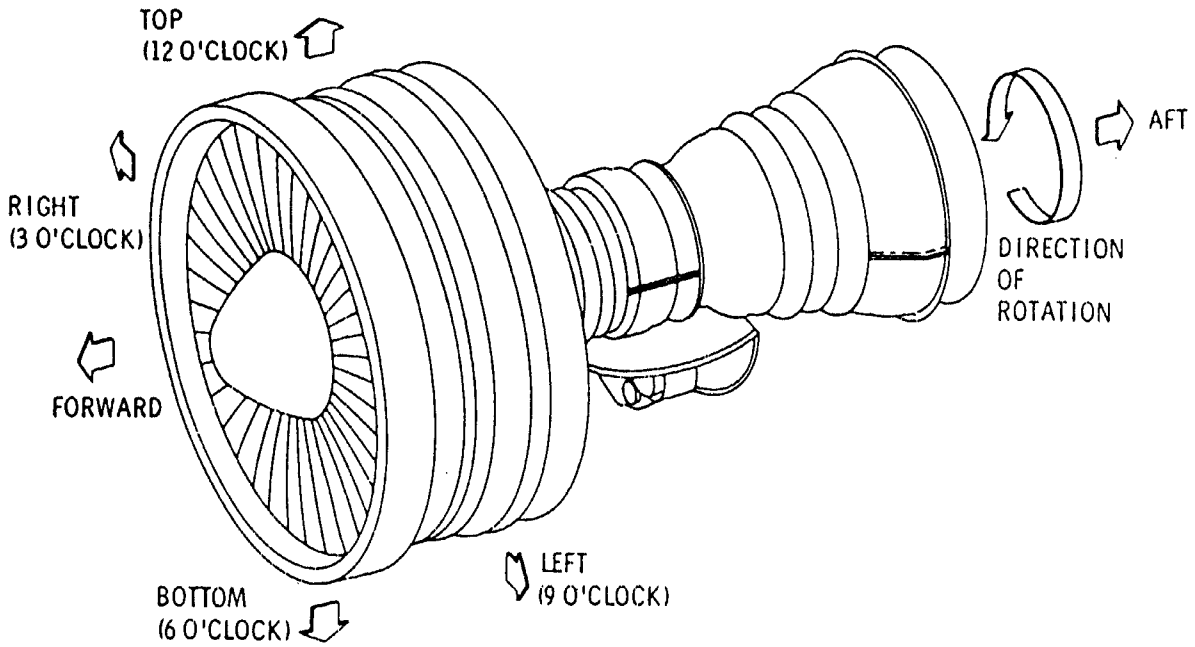
ALG	Accessory Gearbox
ALF	Aft Looking Forward
Assy	Assembly
CDP	Compressor Discharge Pressure
CG	Center of Gravity
CIT	Compressor Inlet Temperature
C/R	Compressor Rotor
CSN	Catalog Sequence Number
C/S	Compressor Stator
Comp	Compressor
CW	Clockwise
CCW	Counterclockwise
Dia	Diameter
Dim.	Dimension
EGT	Exhaust Gas Temperature
ERP	Engine Pressure Ratio
EROM	Electronic Readout Machine
FOD	Foreign Object Damage
Fwd	Forward
Horiz	Horizontal
Hp	Pressure Altitude
HPT	High Pressure Turbine
HPTR	High Pressure Turbine Rotor
ID	Inside Diameter
IGB	Inlet Gearbox
IGV	Inlet Guide Vane
LPT	Low Pressure Turbine
LPTR	Low Pressure Turbine Rotor
LRU	Line Replaceable Unit
Max	Maximum
MEC	Main Engine Control
Min	Minimum
MPA	Maximum Power Assurance

N1	Fan Speed
N2	Core Engine Speed
No.	Number
OD	Outside Diameter
OGV	Outlet Guide Vane.
PMC	Power Management Control
QAD	Quick Attach Detach Ring
Ret	Retaining
Surf.	Surface
TAT	Total Ambient Temperature
TBD	To Be Determined
T2	Fan Temperature Sensor
Tl2	Compressor Inlet Temperature
TGB	Transfer Gearbox
TRF	Turbine Rear Frame
Var	Variable
VBV	Variable Bypass Valve
VSV	Variable Stator Vane
Ve	Computed Airspeed

G. Engine Directional Referenced
(Ref. Fig. 201)
Clockwise, counterclockwise, clock position and other directional references apply to the engine in a horizontal position, viewed from the rear, and with the accessories section at the bottom. When components or struts are numbered in a circumferential direction the No.1 position is at 12 o'clock, or immediately clockwise from 12 o'clock. The remaining positions increase arithmetically in a clockwise direction.
If a Forward - Locking - Aft view is required for hardware location identification, the non-standard view orientation will be indicated on the illustration and a normal clock reference used (3:00 o'clock is right side of illustration) if required.

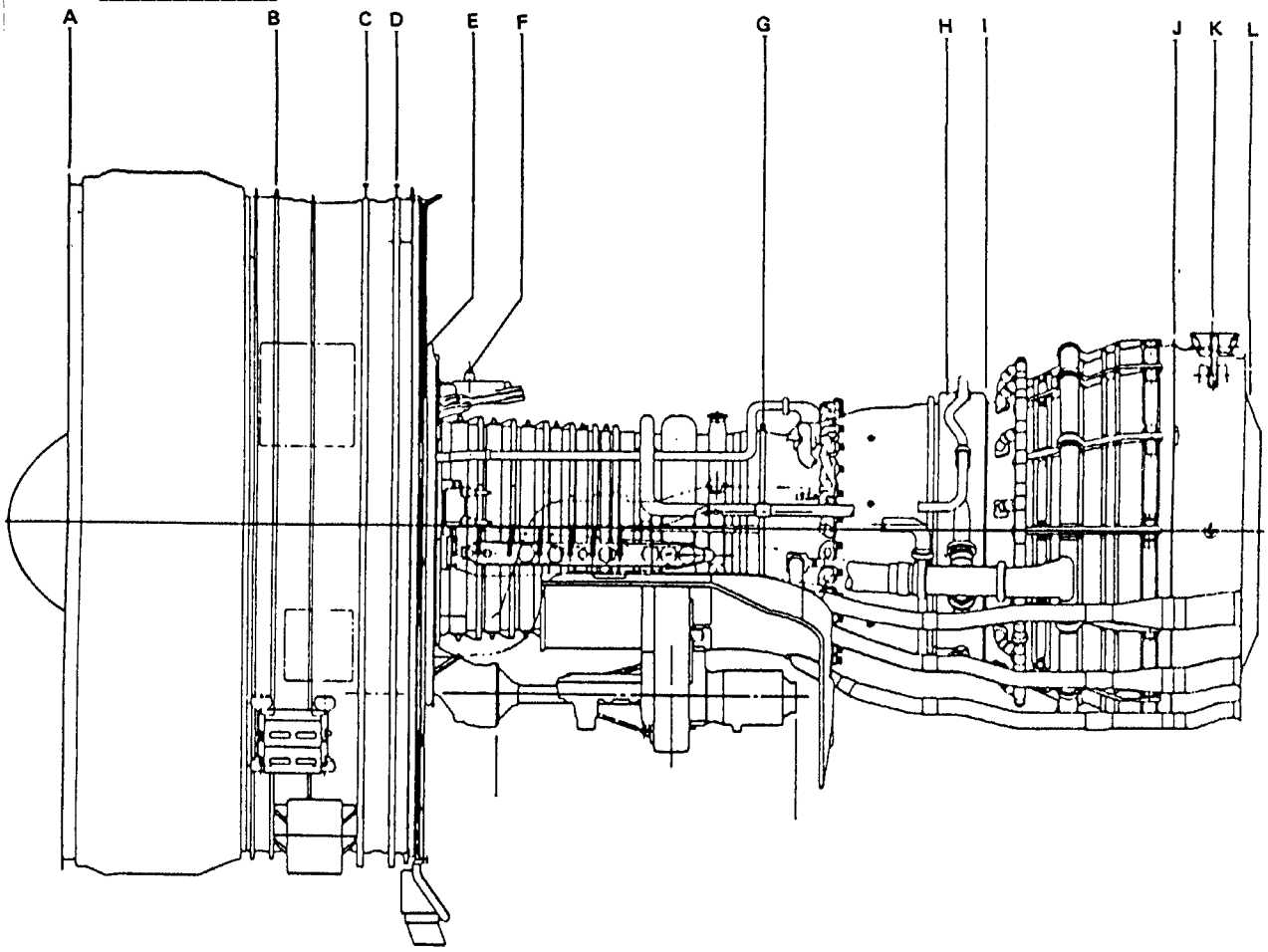
H. Flange Identification
(Ref. Fig. 202)
The external flanges of the engine have been assigned letter designations. The letter designation will be used for flange identification wherever it is necessary to be explicit about flange location, such as positioning of brackets, clamps, bolts, etc.

R J. Engine Position on Aircraft
Data presented in this manual applies to either powerplant, No. 1 or No. 2. There are no notations within the data unless a difference occurs, due to powerplant position. When a difference exists, a statement, **NOTE**, **CAUTION** or **WARNING** will be given as applicable.



BM5 70 00 00 2 LFMO - 00

Engine Directional References
Figure 201



BM5 70 00 00 2 LWMO - 00

Flange Identification
Figure 202

2. Assembly and Disassembly Techniques

A. General

Basic disassembly and assembly practices and techniques are covered in this section. Careful handling of engine parts and proprer use of special tools and fixtures specified in this manual are essential. Damage to engine parts, manufactured to close tolerances, can cause serious engine malfunctions.

B. Cleanliness

CAUTION : IF ANYTHING IS DROPPED INTO AN ENGINE COMPONENT, STOP THE ASSEMBLY PROCEDURE, THEN LOCATE AND REMOVE THE FOREIGN OBJECT EVEN IF COMPLETE DISASSEMBLY IS REQUIRED.

(1) It is important that the assembly shop be clean and dust free, to prevent foreign material from entering the engine or its subassemblies. A major cause of premature engine removal is foreign object damage (FOD). It is recommended that FOD containers be kept at or near each work area.
(2) All parts should be inspected for cleanliness before being installed.
(3) Mating flanges, fittings, and couplings should be wiped clean to ensure obtaining a good seal.
(4) Hands and gloves must be clean when handling machined surfaces.
(5) After performing any work, the area should be thoroughly inspected for loose parts, rags, tools, and materials.

C. Overall Assembly

(1) Before starting disassembly or assembly operations, consult the appropriate section of the manual. The applicable procedure is described in logical step-by-step sequence. Always read the complete procedure ; make certain you understand. It is better to stop and ask, than to continue on and cause unnecessary work and/or damage.
(2) Lift heavy parts with proper fixtures and hoist to prevent damage to parts or injury to personnel.
(3) Perform operations using the tools specified in the engine manual. Maintain tools in good condition and use special tools only for the use intended.
(4) Metal hammers and drifts (including brass) shall not be used to force any part of the engine. To prevent damage, plastic, nylon or rawhide-faced hammers and drifts may be used for driving operations, if necessary.
(5) Complete each phase of assembly before proceeding to the next phase. Do not leave bolts untightened or fasteners unlocked unless specified in the engine disassembly section of the manual.
(6) Do not remove plugs or coverings from parts until part is to be installed.
(7) When installing or removing body-bound bolts, tap them straight through holes. Do not turn them.
(8) During assembly, align matchmarks on all parts which are marked during disassembly or subassembly.
(9) Do not mix plated and unplated hardware. Do not use silver or cadmium plated tools or hardware on titanium parts. Plating contains small quantities of chlorine salts which are harmful to titanium.

WARNING : PROLONGED EXPOSURE OF THE SKIN TO ENGINE OIL MAY BE DETRIMEN-

TAL. WASH SKIN THOROUGHLY AFTER CONTACT, AND REMOVE SATURATED CLOTHING IMMEDIATELY.

CAUTION : ENGINE LUBE OIL MAY SOFTEN PAINT OR STAIN CLOTHING WITH WHICH IT COMES IN CONTACT. CLEAN SPILLED OIL FROM PAINTED SURFACES.

(10)Accessories, tubes, and hoses may have oil or fuel in them at time of removal. Drain these fluids from accessory being removed, and cap all connecting hoses or tubes.

(11)Lubricate all gears and splines with oil before installing them, unless otherwise specified.

(12)Prior to installation of any part, a quick visual check should be made and any obvious discrepancies noted and reported, so that corrective action can be taken.

(13)Do not use external engine piping as a ladder or hand-hold while performing maintenance. Serious engine damage could result. Use only authorized work stands and platforms.

(14)The engine should not be used as a shelf for holding tools or parts while work is being performed.

D. General Assembly Precautions

(1)Do not handle bearings with the bare hands or with any device that could cause contamination or scarring. Use clean rubber or plastic gloves. During assembly of bearings do not apply force to balls or rollers.

(2)Use new cotter pins, lockwashers, tab washers, spring washers, preformed packings, and gaskets throughout assembly. All wirelocking must be done in accordance with the instructions in paragraph 2.

CAUTION : DO NOT PINCH, SQUEEZE, OR OTHERWISE DEFORM ANY SELF-LOCKING NUT TO OBTAIN OR REGAIN SELF-LOCKING TORQUE.

(3)Do not use bolts, screws, or nuts which have damaged threads. Check all beam-type (pinched castellated) and elliptically formed self-locking nuts for locking quality, using the procedure in 70-00-00, Tightening Practices, paragraph 5. I.

(4)Inspect all blind tapped holes and remove any foreign material before installing studs or screws.

(5)The bolts and screws on the engine require a definite tightening torque. Specific torque values are defined in the engine assembly section of the manual. Tighten sets or groups of fasteners holding a single part by using a staggered or diametrically opposite sequence, and do not tighten to final torque at the first drawdown.

(6)When tightening threaded parts that are not rigidly supported, or that are attached to parts that cannot withstand full torque without bending or twisting, use a second wrench and apply countertorque to support the mating part.

(7)Use fiber or plastic blocks to protect engine parts being assembled by means of pressing.

(8)Tube and tube connectors.

CAUTION : REMOVE PROTECTIVE COVERS AND PLUGS IMMEDIATELY BEFORE ASSEMBLY.

(a)Check cleanliness, especially on seals and threaded areas.

(b)Inspect the tube assembly to ensure satisfactory general condition and that no handling damage has occurred.

(c)Install the tube assembly without application of force ; however, a slight eleastic distortion is allowed for engagement of connectors.

(9)Use of motor-driven hydraulic pumps to operate hydraulically actuated special support equipment other than torque multipliers is not recommended. Equipment damage can result from improper power application. Use hand-operated hydraulic pumps to operate hydraulically actuated special support equipment such as pushers or pullers, unless otherwise specified.

E. Electrical Bonding Straps

Electrical bonding strap contact surfaces shall be prepared by removing all anodic film, grease, paint, lacquer, or other high-resistance material from an area at least one and one-half times the bonding surface contact area.

F. Marking of Parts

(1)General

Parts or assemblies designated as matched will be maintained as matched sets throughout the maintenance process. Set numbers, part numbers, and serial numbers will be protected during cleaning or rework to prevent removal. When identification is removed or is no longer legible, the item must be re-marked per the original marking method and location for the part as specified on the applicable drawing.

(2)Permanent marking

Permanent marking of parts should be done in the area of lowest stress as specified on applicable drawing. Methods are listed in order of preference (unless otherwise specified). Electric etch is not approved.

(a)Electro-chemical etch-preferred.

(b)Vibro-peen-acceptable.

(c)Metal stamp - special use only.

(3)Temporary marking

CAUTION : WHENEVER IT IS NECESSARY TO MARK ANY ENGINE PARTS, ONLY APPROVED MARKING COMPOUNDS SHALL BE USED. USE OF UNAUTHORIZED MARKING COMPOUNDS CAN CAUSE DAMAGE TO ENGINE PARTS.

CAUTION : GREASE PENCILS OR LEAD (GRAPHITE) PENCILS MUST NOT BE USED TO MARK COMBUSTION SECTION AND HOT SECTION PARTS. THESE MATERIALS PLUS HEAT CAN CAUSE PARTS MATERIAL DAMAGE.

Refer to paragraph 4. for acceptable methods and materials.

G. Correction of Leaks

CAUTION : DO NOT OVERTORQUE THREADED FASTENERS AS MEANS TO CORRECT LEAKING CONNECTIONS. PARTS FAILURE COULD RESULT.

(1)Disassemble connection.

(2)Discard seal, gasket, or preformed packing (O-ring), if present.

(3)Inspect mating surfaces for contamination, scratches, dents or other surface defects.

(4)Inspect threaded fasteners for thread damage and assure that fasteners seat properly when torqued to specified value.

(5)Replace nonserviceable parts and assemble connection using new seals, gaskets, or performed packings, as required.

H. Unpacking and Repacking

The following general instructions apply during unpacking and repacking to minimize possible part damage and contamination.

(1)Initially remove only that portion of the pack necessary to mount the part. Where possible, remove the remainder of the pack, including protective closures, one at a time as each connection (fluid, air, or electrical) is made.
(2)Retain protective closures and reusable pack components for repack purposes.
(3)Install closures on each connection (fluid, air, or electrical) as it is disconnected.
(4)When possible, repack part for storage or shipment using the same pack in which replacement part was received.
(5)When original pack components are not available, use locally available packing materials and container to pack the part. Make certain that all ports, openings, connections, and mating surfaces are capped or covered and that the part is protected from potential handling and environmental damage.

R J. Jackscrews
(1)When using jackscrews to remove components, do not bend flanges or strip threads. Lubricate jackscrews with engine oil before installing. Turn jackscrews evenly and in small increments. Always check jackscrews for burrs or rough edges before using. Remove all burrs or rough edges. Do not allow components to fall free as jackscrews are tightened.
(2)Jackscrew holes are often in flanges only thick enough to accept 3 or 4 threads. If regular bolts are used as jackscrews, the tips must be blunt and polished. The ends of most standard bolts are chamfered, and the first couple of threads are missing or incomplete. These should not be used as jackscrews without modification, since one or 2 threads will engage, and the threads in the flange are likely to strip. Jackscrews, frequently designed as such and identified as special tools, are not chamfered and full thread engagement will occur. If specially manufactured jackscrews are not available and must be locally manufactured, make certain that the ends are ground to remove the chamfers and the incomplete threads, so that a maximum number of threads may be engaged.

R K. Protective Closures and Caps
(1)Prevent foreign material from lodging in drilled passages, fuel lines, oil lines, air lines, and open engine ports. Machined surfaces must be properly protected to prevent damage.
(2)Wrap precision parts and cap or plug all openings and connections. It is most important that all engine parts be kept clean and free of corrosion. All instructions which require special handling of parts must be followed without exception.
(3)Accessories, tubes, and hoses may have oil or fuel in them at time of removal. Drain these fluids from accessory being removed, and cap all connecting hoses or tubes - do not use tape.
(4)Do not remove plugs, caps, etc., until part is ready for assembly. Check both seating surfaces for removal of plugs, etc., prior to assembly.

R L. Gaskets and Preformed Packing Seals
CAUTION : APPLY ONLY ENOUGH LUBRICANT TO WET THE SURFACE OF THE PREFORMED

PACKING AND ADJACENT SURFACE.
TOO MUCH LUBRICANT CAN CAUSE CONTAMINATION WHICH CAN CAUSE LEAKS.

CAUTION : USE A PROTECTIVE DEVICE WHEN YOU INSTALL PREFORMED PACKINGS OVER THREADS OR SHARP CORNERS OR DAMAGE TO THE PREFORMED PACKING CAN OCCUR.

CAUTION : DO NOT USE SHARP OR POINTED TOOLS TO REMOVE THE PREFORMED PACKINGS OR DAMAGE TO THE PREFORMED PACKING SEALING SURFACE CAN OCCUR.

(1)Gaskets and preformed packing seals shall not be reused unless otherwise specified.

(2)Do a visual examination of the gaskets for reuse as follows :

(a)Gaskets constructed of aluminum, with flexible, imbedded sealing material are reusable provided the following limits are met.

1 No nicks, cuts, or gouges across sealing surfaces.

2 Sealing material is not hard or brittle.

3 Sealing material protrudes at least 0.018 in. (0.46 mm) above the metal surface (Ref. Fig. 203).

4 No evidence of seal material extrusion or cold flow.

NOTE : The thin lacy sealing material that extends beyond the normal sealing surface is serviceable.

CAUTION : MAKE CERTAIN NO CONTACT IS MADE WITH SEAL MATERIAL, WHEN USING POLISHING STONE.

5 Raised metal may be removed using a fine polishing stone or equivalent.

(3)Gaskets and preformed packing seals shall be lightly lubricated with petrolatum (Material No. C02-033), petroleum jelly (Material No. C02-008), grade 1010 oil (Material No. C02-021), or engine lubricating oil (Material No. C02-019 or C02-023) prior to installation unless otherwise specified.
When it is required that the preformed packing (o-ring) have a tacky assembly fluid to retain the packing in the seal groove (to minimize the risk of damage during assembly) the use of Ultrachem assembly fluid (Material No. C02-007) or Novagard (Material No. C02-090) is permitted.
Make certain parts are properly seated in the special case of a fitting with a jamnut and preformed packing.

R M. Tubes

(1)As tubes are installed, tighten all end fittings and clamps fingertight. After a complete system is installed, torque clamps first, then end fittings.

(2)Maintain clearance between tube and each adjacent part.

(3)Coupling nuts shall thread freely by hand.

(4)Mating flanges on tube shall seat flush.

(5)If tubes are reworked, bend radii shall not be less than twice the tube diameter and bend angle shall not be changed by more than 3 degrees. No kinks or wrinkles are allowed.

(6)Do not bend at fitting or weld areas.

(7)Original bends in tube may be bent in the same direction ; no reverse bending is allowed.

(8)Bend tube in existing straight sections if possible.

(9)Use bending tools on tubes, one in. (25.4 mm) or more in diameter, to

prevent tube from collapsing.

(10)On those couplings where sealant is required, allow sealant to dry 10 minutes minimum before assembly. Wipe off any sealant on inside of tube with a clean cloth and water. Do not allow sealant to enter air systems.

R N. Clamps (Ref. Fig. 204)

Chafing of hoses and tubes must be avoided. Clamp parts loosely in place, shift the hoses around to obtain best clearance, then tighten clamps. Clamps must be proper size for piping to permit slippage during engine thermal growth.

R P. Electrical Cables and Connections

(1)During electrical cable installation, adjust the cable through the clamps to get the smoothest and largest radii. Sharp bends, twists, and kinks must be avoided. Minimum clearance between the electrical cable and any component other than hoses or other electrical cables is 0.125 in. (3.2 mm).

CAUTION : DO NOT FORCE THE CONNECTORS TOGETHER. IF PINS ARE NOT ALIGNED, THEY WILL BE BENT OR DISTORTED AND WILL NOT MAKE COMPLETE CONTACT.

(2)Inspect electrical connector pins for straightness before connecting. Then insert the mating cable connector, handtighten the retaining nut, push the mating parts together until seated, and tighten the retaining nut, as required.

(3)A seal ring is located in coupling nut of each electrical connector. Inspect to make certain seal is present and serviceable before attaching the connector. Replace unserviceable seals as follows :

(a)Remove unserviceable seal.

(b)Engage new seal over barrel of connector.

CAUTION : DO NOT ALLOW THE SEAL TO TIP AND FLATTEN ON THE CONNECTOR OR SEAL USEFULNESS WILL BE DESTROYED.

(c)Push the seal to seated position against the internal shoulder in the connector using a mating connector or blunt screwdriver.

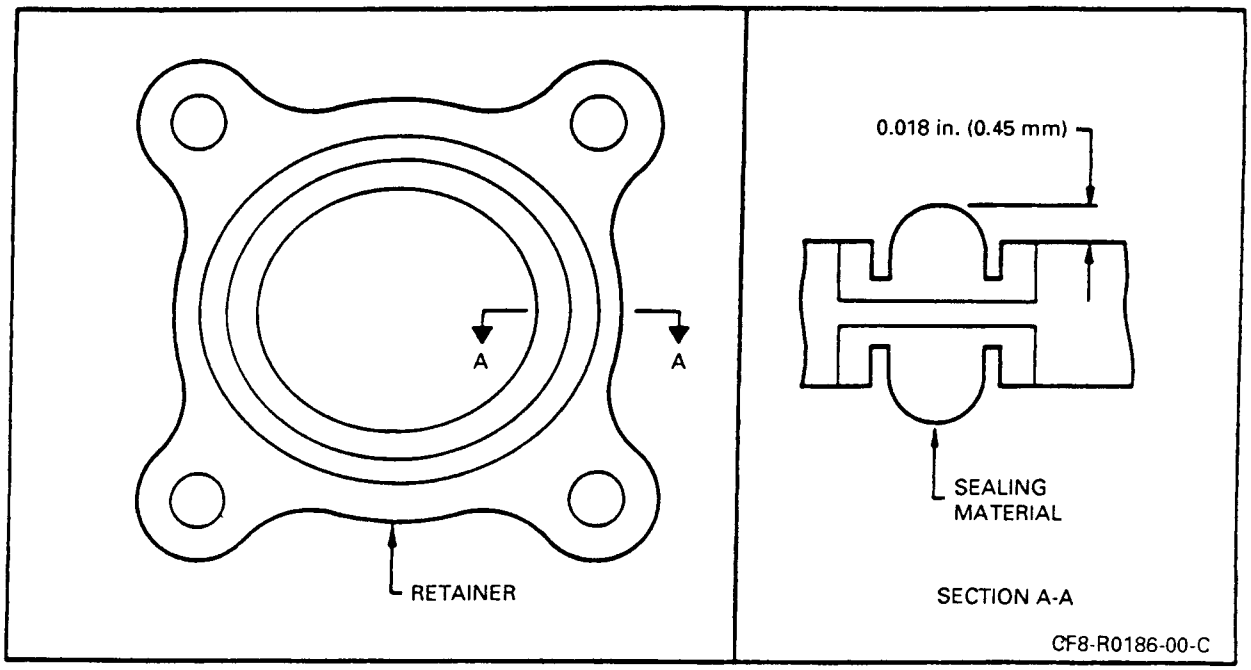
(4)Electrical connectors on flexible harnesses and leads shall be hand-tightened beyond fingertight, 20 degrees maximum, until connecting parts are in solid contact without damage. Wirelock the connectors only when specified in procedure.

(5)Do not bend sharply, kink, or twist rigid leads. Always hold both mating connectors when tightening the connection to prevent damage to lead.

R Q. Hoses (Ref. Fig. 205)

(1)No hose should be bent, especially when the parts are cold, because of possible damage to the Teflon liners. Kinked hoses must not be used. During installation, make certain that no hose is twisted or stretched ; never over-torque connectors. When hoses are removed, cap the open ends. Do not use tape.

(2)Fluid fittings shall be tightened gradually to the required torque value, backed off 0.25 turn then tightened again. Do not attempt to correct a leak by excessive tightening. Always use 2 wrenches when tightening swivel coupling nuts on hoses, tubes, or fittings. Hold the stationary



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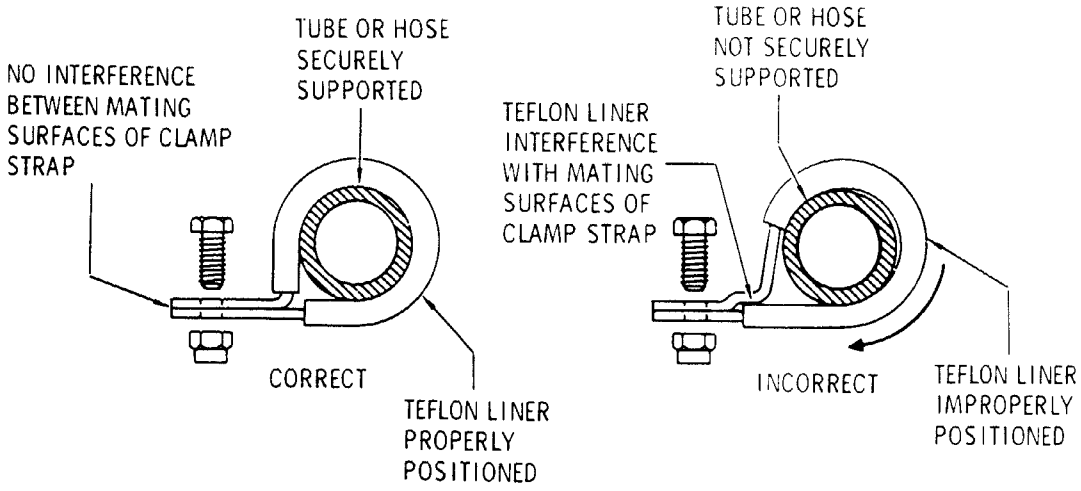
Typical Metal Gasket
Figure 203


NO INTERFERENCE BETWEEN MATING SURFACES OF CLAMP STRAP
TUBE OR HOSE SECURELY SUPPORTED
CORRECT
TEFLON LINER PROPERLY POSITIONED
TUBE OR HOSE NOT SECURELY SUPPORTED
TEFLON LINER INTERFERENCE WITH MATING SURFACES OF CLAMP STRAP
INCORRECT
TEFLON LINER IMPROPERLY POSITIONED

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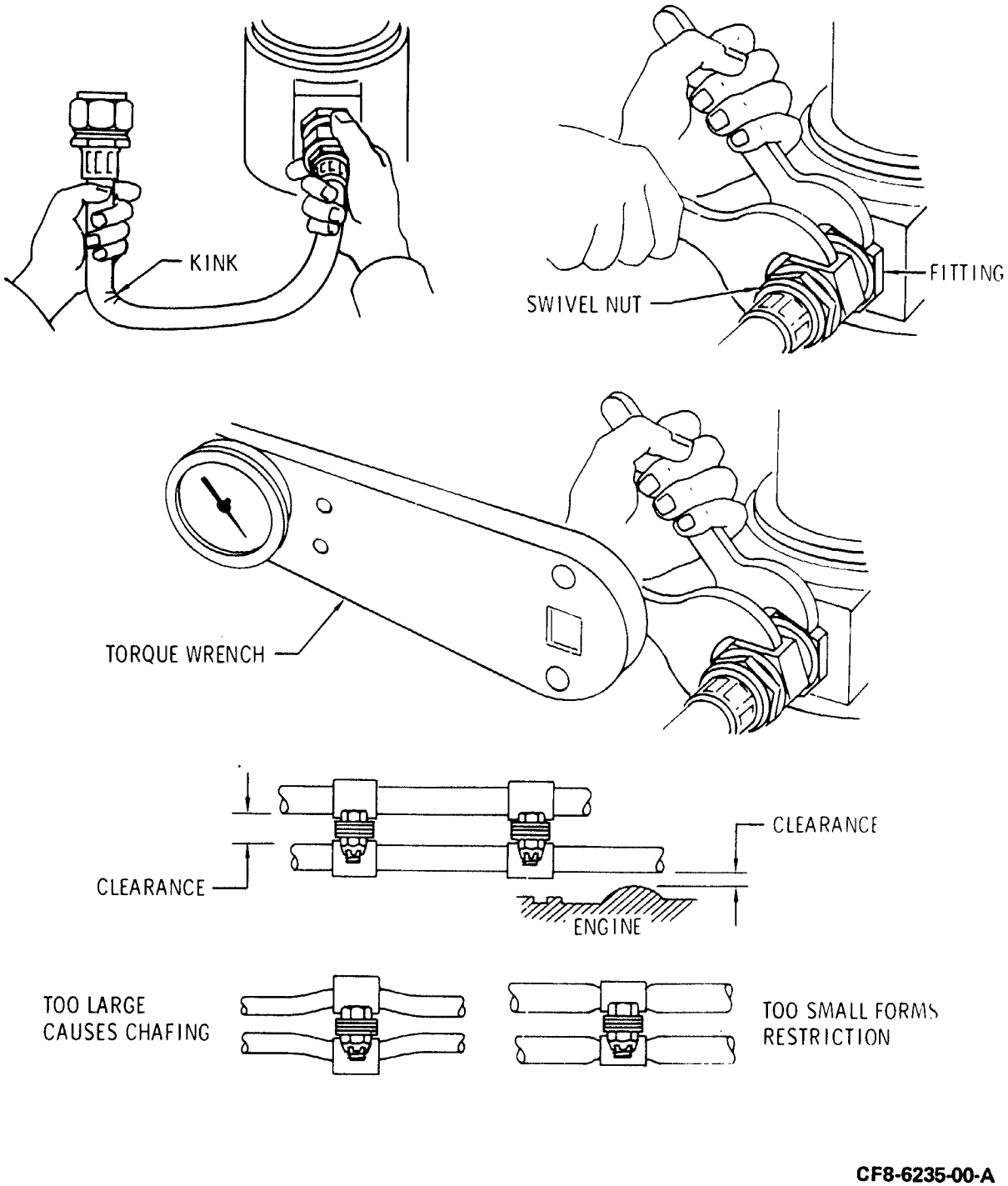
Installation of Clamps
Figure 204

part with one wrench while applying torque with second wrench. Apply lube oil between tube-hose coupling nut and ferrule prior to tightening.

(3) Preformed hoses or hoses of large diameter shall not be bent or straightened. When hoses are removed, cap the open ends. Do not use tape.

(4) Before installing preformed hoses, visually inspect the hose interior to assure that the Teflon lining has not been damaged. Replace the hose if the lining has been damaged.



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Installation of Hoses
Figure 205

3. Locking Procedures

A. General
This section describes the standard practices for securing parts, by use of wirelock, safety cable, cotter pins, and tab washers. These devices are not a means of obtaining or maintaining torque, but are a safety measure to prevent the disengagement of fasteners and other parts by opposing any force tending to disengage the fasteners.

B. Wirelocking Practices (Ref. Fig. 206)
(1)Wirelocking is the securing of 2 or more parts with a wire which shall be installed so that any tendency of the part to disengage will be counteracted by additional tightening of the wire. When installing lockwire, observe the following general recommendations and specific techniques.
(2)General recommendations for wirelocking
(a)Where possible, install stainless steel lockwire (AMS 5689) by twisting 2 strands together (the double-twist method). One twist is defined as that produced by twisting the wires through an arc of 180 degrees and is equal to one-half a complete turn.
The single strand method (Ref. 3. (Ref. Fig. 206)) may only be used when specified.
(b)Do not install lockwire in such a way as to cause the wire to be subjected to chafing, fatigue through vibration, or additional tension other than the tension imposed on the wire to prevent disengagement.
(c)In all cases, wiring must be installed through the holes provided. When no hole is provided, attach the wire to a neighboring part so as not to interfere with the function of the parts, and in accordance with the recommendations of this section. (Ref. 6 and 7, (Ref. Fig. 206)).
(d)The maximum span of lockwire between tension points shall be 6 in. (152.4 mm), unless otherwise specified. Where several fasteners form a group to be wirelocked together by either the single-strand or the double-twist method, the maximum number of units in a series shall be limited to the number of units that can be wirelocked by a 24 in. (609.6 mm) length of wire. When wirelocking widely spaced units in a group, using the double-twist method, not more than 3 units shall be wirelocked in a series. (Ref. 8 and 9, (Ref. Fig. 206).
CAUTION : ALWAYS USE NEW LOCKWIRE, AND MAKE CERTAIN THAT IT MEETS THE SPECIFICATIONS NOTED BELOW.
(e)Both 0.020 ± 0.001 in. (0.51 ± 0.03 mm) and 0.032 ± 0.001 in. (0.81 ± 0.03 mm) stainless steel (AMS 5689) lockwires are used throughout the engine. The choice is determined by the size of the hole in the unit to be wirelocked. Whenever possible, use the 0.032 in. (0.81 mm) lockwire.
(f)Pull lockwire taut while twisting it. The twisted wire should have 9 to 12 twists per in. for 0.020 in. (0.51 mm) wire, and 7 to 10 twists per inch for 0.032 in. (0.81 mm) wire.
(g)Wirelock hose and electrical coupling nuts in the same manner as the tube coupling nuts. (Ref. 6, 7, 10, 11, 12, and 13, (Ref. Fig. 206).
(h)Exercise caution during the twisting operation to keep the wire tight without overstressing it or permitting it to become nicked, kinked, or otherwise mutilated.

R (j)The use of commercially available lockwire twisting tools is recommended. Two such tools are shown (Ref. Fig. 207).

(3)Specific Techniques for Wirelocking (Ref. Fig. 208)

CAUTION : LOCKWIRE IS NOT RESUABLE. ALWAYS USE NEW LOCKWIRE

(a)Check the lockwire holes of the parts to be wirelocked for proper alignment. If a part has been tightened to the proper torque, but is improperly aligned, replace it with another part.

NOTE : Proper alignment means that the lockwire holes are aligned so that the installed lockwire will prevent disengagement of the part. Do not exceed torque limits of any part in an attempt to align the holes.

(b)Insert the lockwire through the first part, and bend the upper end either over the head of the part or around it. If bent around it, the direction of wrap and twist of the strands shall be such that the loop around the part comes under the strand protruding from the hole. Done this way, the loop will stay down and will not tend to slip up and leave a slack loop. Ref. 1 and 2, (Ref. Fig. 208).

(c)Twist the strands while taut until the twisted part is just short of a hole in the next part. The twisted portion should be within 0.125 in. (3.18 mm) of the hole in the other part. Ref. 3 and 4, (Ref. Fig. 208).

(d)If the free strand is to be bent around the head of the second part, insert the uppermost strand through the hole in this part, then repeat step (2). If the free strand is to be bent over the unit, the direction of twist is unimportant. If there are more than 2 units in the series, repeat the preceding steps, Ref. 5 and 6, (Ref. Fig. 208).

(e)After wiring the last part, continue twisting the wires to form a pigtail of 3 to 6 twists 0.250 - 0.50 in. (6.4 - 12.7 mm) long and cut off the excess wire. Bend the pigtail inwards toward the part to prevent its becoming a snag. Ref. 7 and 8, (Ref. Fig. 208).

NOTE : Although every possible combination of wirelocking is not shown in figure 1, all wirelocking must conform generally to the examples shown.

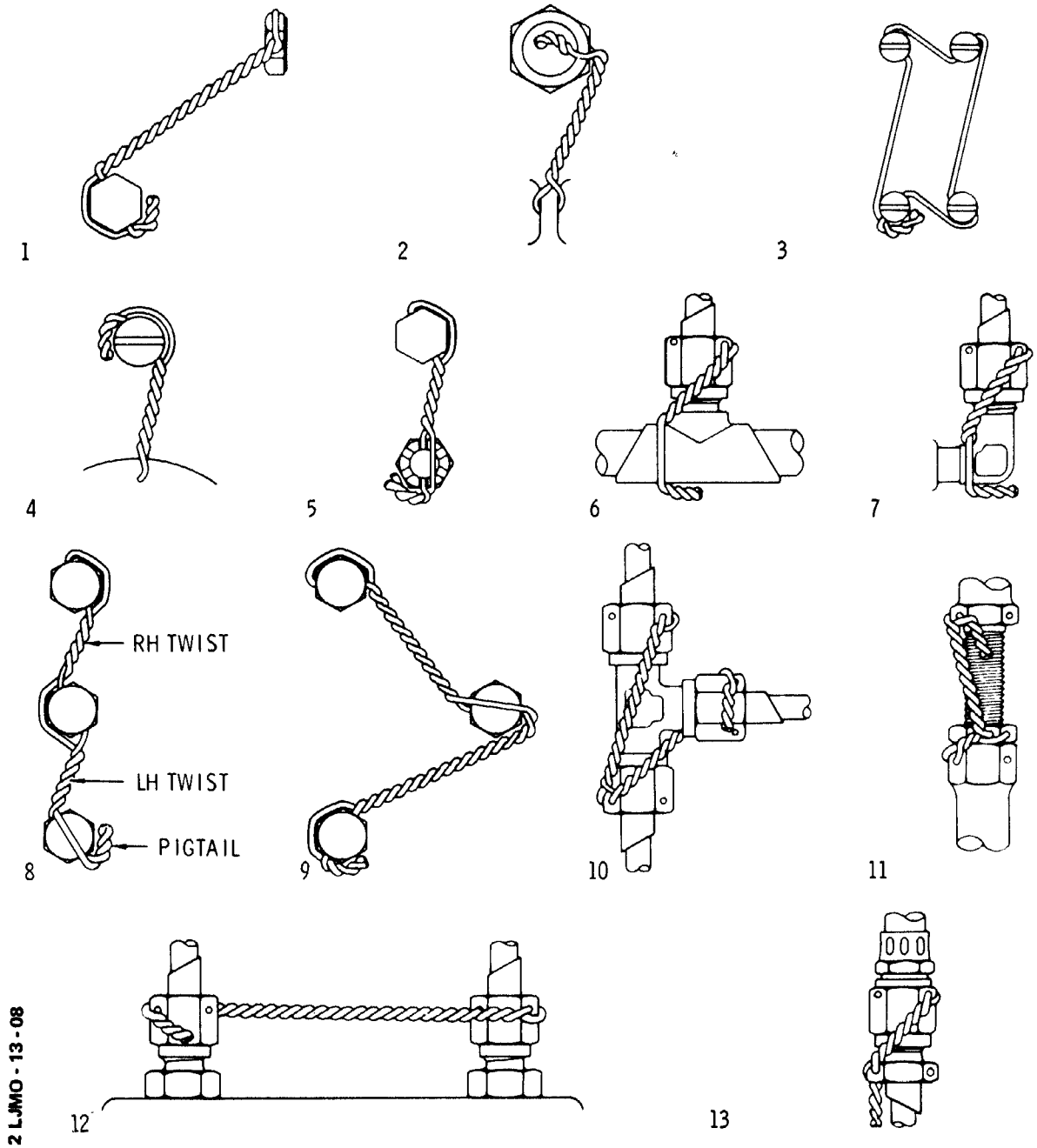
(f)If, after wirelocking in accordance with the preceding instructions, the lockwire is not taut, use the following limits to determine its acceptability.

NOTE : Apply light finger-pressure to the midpoint of the lockwire span, and flex in both directions.

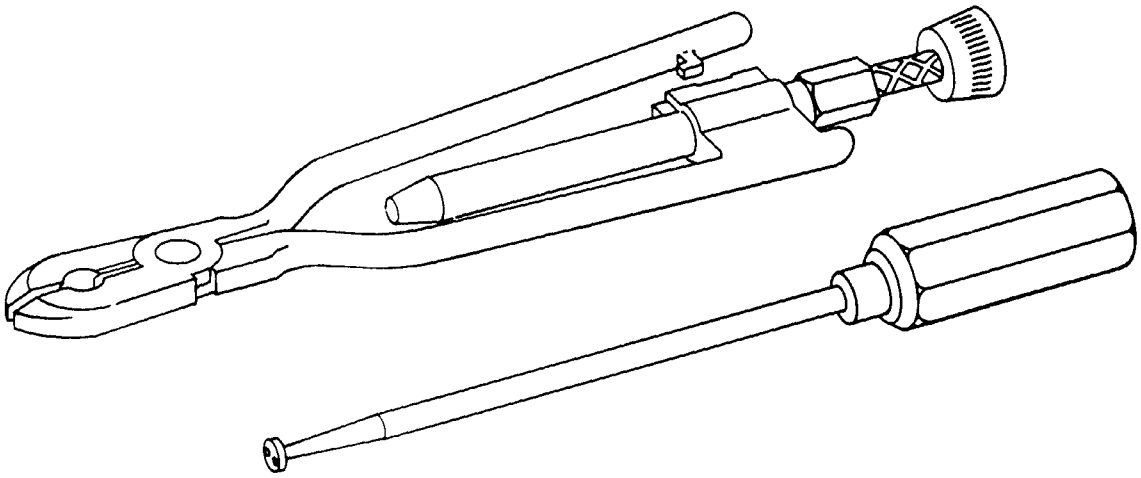
Length of Lockwire Between Parts	Maximum Flexing At Center
0.5 in. (12.7 mm)	0.125 in. (3.2 mm)
1.0 in. (25.4 mm)	0.250 in. (6.4 mm)
2.0 in. (50.8 mm)	0.375 in. (9.5 mm)
3.0 in. (76.2 mm)	0.500 in. (12.7 mm)
4.0 in. (101.6 mm)	0.750 in. (19.1 mm)
5.0 in. (127.0 mm)	0.750 in. (19.1 mm)
6.0 in. (152.4 mm)	0.750 in. (19.1 mm)

(g)If lockwire fails to meet these limits, remove it and install new lockwire.

(h)Always cut rather than break lockwire so that lockwire holes are not torn or damaged.



Wirelocking Practices
Figure 206



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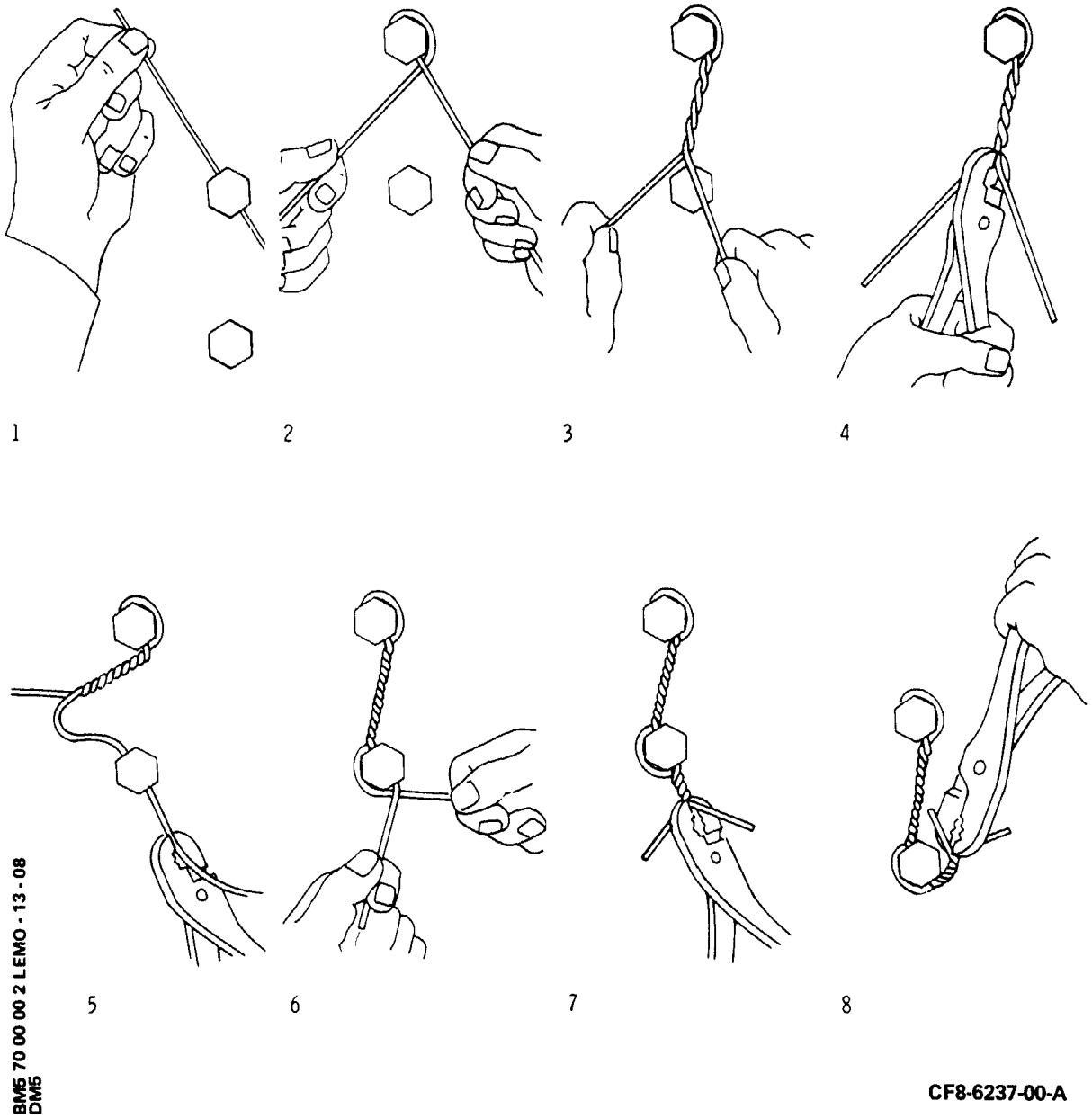
Typical Lockwire Twisting Tools
Figure 207

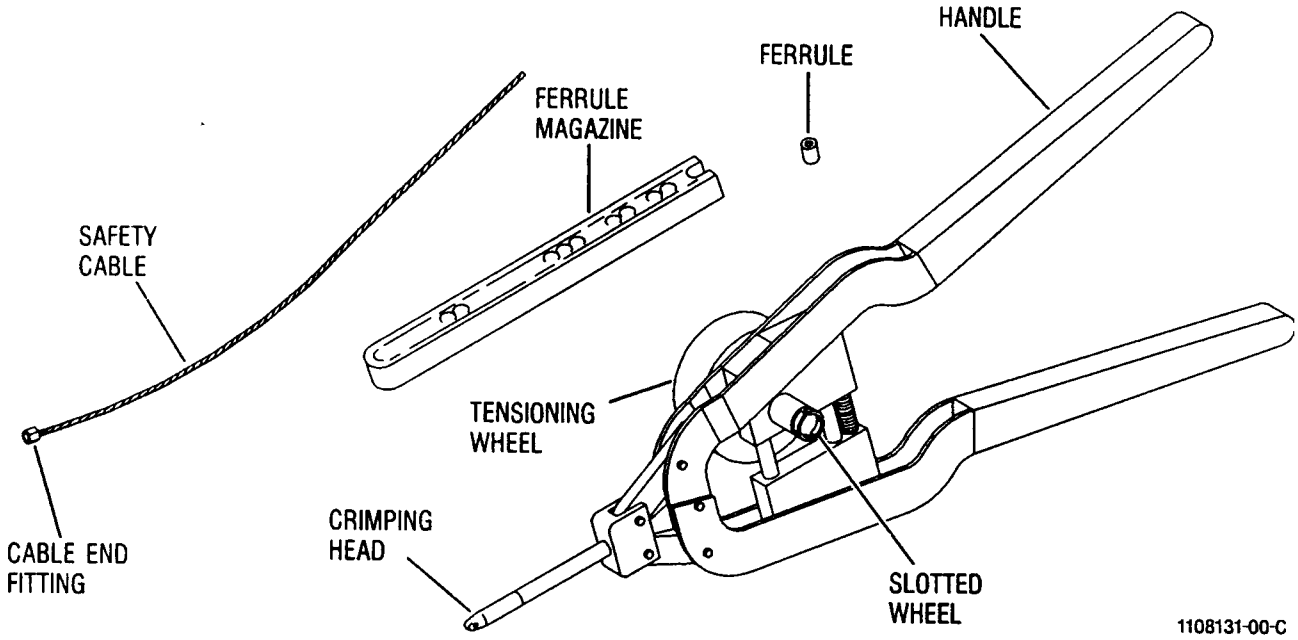


Wirelocking Techniques
Figure 208

C. Safety Cable Description
(1)Safety cable is an alternative to lock wire. Safety cable is installed through two or more parts so that as the part loosens, the safety cable will tighten. When the safety cable tightens, it will not let the part turn.
(2)The safety cable system has three components : the safety cable, ferrules, and crimping tool.
(Ref. Fig. 209, 210)
(a)The safety cable (C10-145) is available in one size, 0.032 in. (0.81 mm), and is made of AMS 5689 (321 stainless steel) material. One end of the cable has a fitting swaged to it. The fitting is made of AMS 5674 (347 stainless steel) material. The strands on the opposite end of the cable are fused together to prevent the cable from fraying.
(b)The ferrules (C10-144) are made of AMS 5674 (347 Stainless Steel) material and are in a spring-loaded, disposable magazine. When the safety cable is installed, the ferrule is crimped on the open end of the cable.
(c)There are two types of safety cable tools :
1 The Bergen crimping tool (C10-148) (Ref. Fig. 209).
This tool comes in different lenghts.
The crimping pressure of the tool is set by the manufacturer.
The primary parts of the crimping tool are the crimping head, tensioning wheel, slotted wheel, and handles.
This tool crimps the ferrule on the end of the safety cable.
The crimping tool cuts the safety cable against the ferrule at the same time the ferrule is crimped.
2 The Snap-on crimping tool (C10-148) (Ref. Fig. 210)
This tool operates in one direction only. It has a cycle-end dead stop to let the operator know when the ferrule is fully crimped.
The crimping pressure of the tool is set by the manufacturer.
If necessary, you can adjust the crimping pressure with standard hand tools. The Snap-on tool has a spring loaded crimp rod to hold the ferrule in place during the crimping procedure. The internal retraction mechanism controls cable tension automatically.

D. Safety Cable Practices
(1)Where possible, install the safety cable so it does not touch other parts.
(2)Make sure the cable is not damaged or bent when you install it. Frayed cable assemblies are not permitted.
(3)Install the safety cable only through holes that exist.
(4)Unless specified differently in the maintenance manual :
(a)The maximum length of the safety cable between safety cabled parts is 6.0 in. (152 mm).
(b)Do not safety more than three bolts with one safety cable.
(c)Do not use safety cable on titanium fasteners.

E. Crimping Tool Verification - Bergen Tool (C10-148) - Test Block (C10-146) Procedure (Ref. Fig. 209, 211)
NOTE : You can use the safety cable tester (C10-147) as an alternative to this test. Refer to the manufacturer's instructions.



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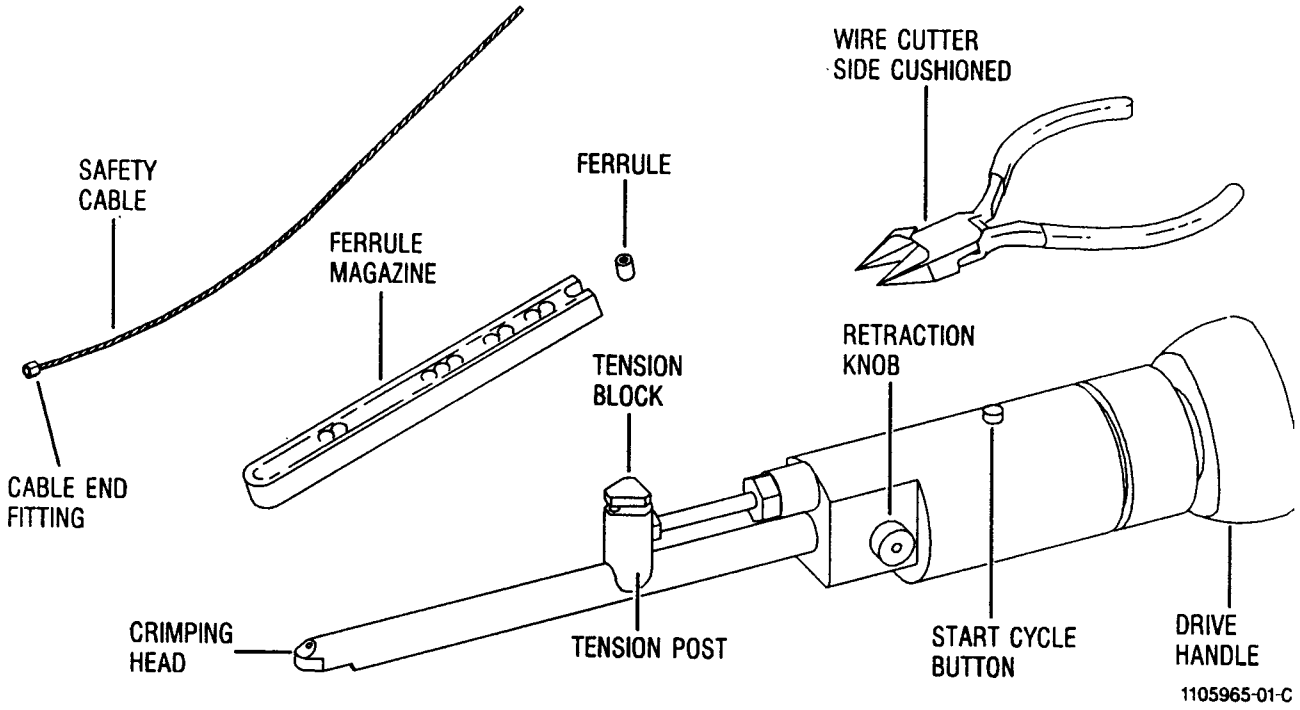
Bergen Crimping Tool (C10-148) -
Safety Cable Components
Figure 209



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Snap-On Crimping Tool (C10-148) -
Safety Cable Components
Figure 210

(1)Do a pulloff load test as often as necessary. You must make sure the crimp is in the limits.

(2)Prepare for the pulloff load test as follows :
(Ref. Fig. 209, 211)

(a)Set up the test block (C10-146). Refer to the manufacturer's instructions for set-up information.

(b)Make sure the pivot joint is in the forward direction.

(c)Move the cable stop at the end of the test block.

(d)Install the safety cable (C10-145) through the cable stop hole.

(e)Pull the safety cable through the cable stop hole.

(f)Put the safety cable through the hole in the pivot joint and pull the cable through the hole.

(g)Put the end of the safety cable (from the pivot joint) through a ferrule (C10-144) in the ferrule magazine.

(h)Pull the safety cable through the ferrule. Use the safety cable to pull the ferrule out of the ferrule magazine (Ref. Fig. 212) (step 2).

R (j)Put the end of the safety cable through the crimping head of the crimping tool (C10-148) (Ref. Fig. 212) (step 3).

R (k)Make sure the large hole in the crimping head is on the same side as the ferrule.

R (l)Move the crimping tool along the safety cable until the crimping head is against the part (Ref. Fig. 212) (step 4).

R (m)Make sure the ferrule is fully in the hole in the crimping head.

R (n)If the ferrule will not go in the crimping head, do the procedure that follows :

1 Remove the cable from the crimping tool.

2 Push the handles together.

NOTE : When the handles are released they will open automatically.

3 Put the cable back through the crimping head.

4 Move the crimping tool along the safety cable until the crimping head is against the part.

5 Make sure the ferrule goes into the hole in the crimping head.

CAUTION : **DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL BREAK THE SAFETY CABLE.**

R (p)Put the safety cable across the slotted tensioning wheel on the side of the crimping tool.

1 Make sure the cable is in the two slots in the wheel that are in line with the crimping head.

2 Hold the crimping tool perpendicular to the cable. Make sure the ferrule is tightly against the bolt head.

3 Turn the tensioning wheel on the side of the crimping tool until you hear clicks (Ref. Fig. 212) (step 5).

CAUTION : **DO NOT CRIMP THE FERRULE UNLESS THE CORRECT TENSION IS APPLIED BY THE TENSIONING WHEEL. AN INCORRECT CRIMP WILL OCCUR IF THIS IS NOT DONE CORRECTLY.**

4 Apply constant pressure to close the crimping tool handles until the cable is cut.

NOTE : Do not try to remove the crimping tool from the ferrule with the handles in the crimped or closed position.

If the handles on the crimping tool are not completely closed when released, the handles will not open.

5 Release the pressure on the handles.

6 Remove and discard the unwanted safety cable from the tensioning wheel.

R (q) Do a finger-pressure test as follows (Ref. Fig. 211) :

1 Find the center of the safety cable in the test block.

2 Use light finger pressure and push the center of the safety cable to the wall on the test block. The safety cable must not touch the wall.

R (r) If the safety cable does not touch the wall, then the safety cable is serviceable. Do the pulloff load test in paragraph E. (3).

R (s) If the safety cable touches the wall, the safety cable is not serviceable.

1 Cut the safety cable with side-cushioned diagonal cutter (C10-149) and remove the safety cable from the test block.

2 Install a new safety cable and do steps E.(2)(a) thru E.(2)(p) again.

3 Do a check to make sure of a serviceable crimp as follows :

- Make sure the tension on the safety cable is correct.
- When you crimp the ferrule, hold the crimping tool perpendicular to the safety cable.
- Make sure the ferrule is tightly against the bolt head.

4 If the safety cable touches the wall again, do not use the crimping tool.

(3) Do the pulloff load test as follows (Ref. Fig. 211) :

(a) Set a calibrated breakaway TORQUE wrench to 70 lbf.in (0.79 m.daN).

(b) Install the torque wrench in the pivot joint on the test block (C10-146) (Ref. Fig. 211).

(c) Move the torque wrench handle counterclockwise until the torque wrench clicks or the ferrule moves.

(d) If the ferrule moves before you hear the torque wrench click, remove the crimping tool from service.

(4) Do the finger-pressure test again (Ref. Fig. 211).

(a) Find the center of the safety cable in the test block.

(b) Use light finger pressure and push the center of the safety cable to the wall on the test block.

(c) If the safety cable does not touch the wall you can use the crimping tool (C10-148).

(d) If the safety cable touches the wall, do not use the crimping tool (C10-148).

(5) Do a test to find the amount of pressure necessary to cause the crimped ferrule or safety cable to break.

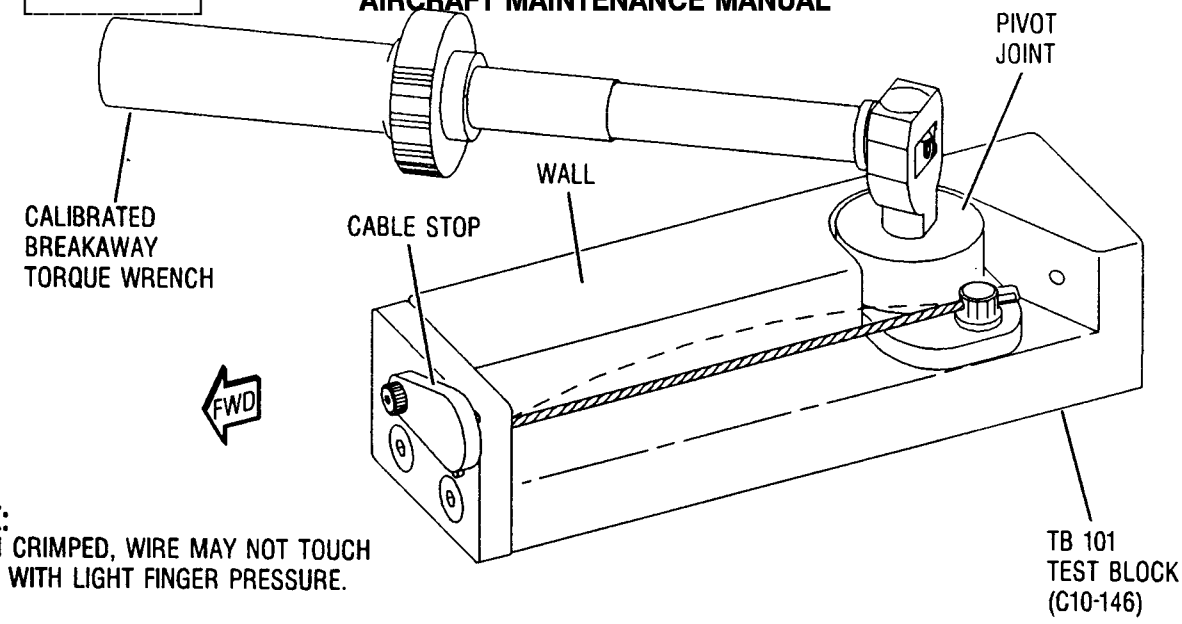
(a) It is recommended that this test be done a minimum of one time each month.

(b) Use a safety cable tester (C10-147) to do this test (Ref. Fig. 211). Refer to the manufacturer's instructions.

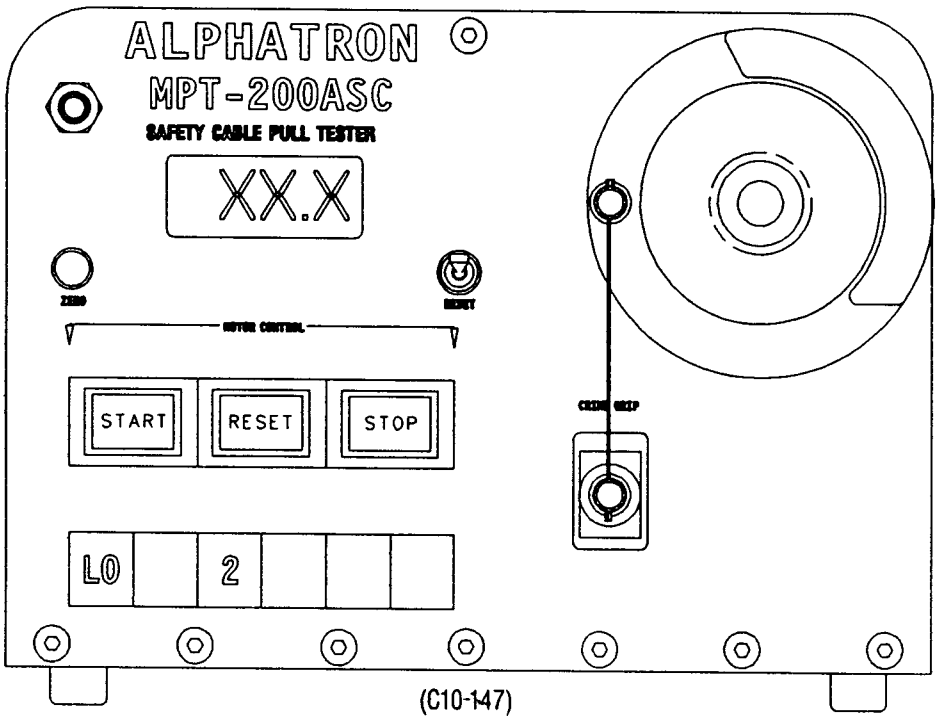
(c) This test can also be used as an alternative to the test block (C10-146) test (Ref. step E.).

F. Safety Cable Installation - Bergen Crimping Tool (C10-148)

(1) Do a visual inspection of the holes to be safety cabled to find all



NOTE:
WHEN CRIMPED, WIRE MAY NOT TOUCH WALL WITH LIGHT FINGER PRESSURE.



(C10-147)

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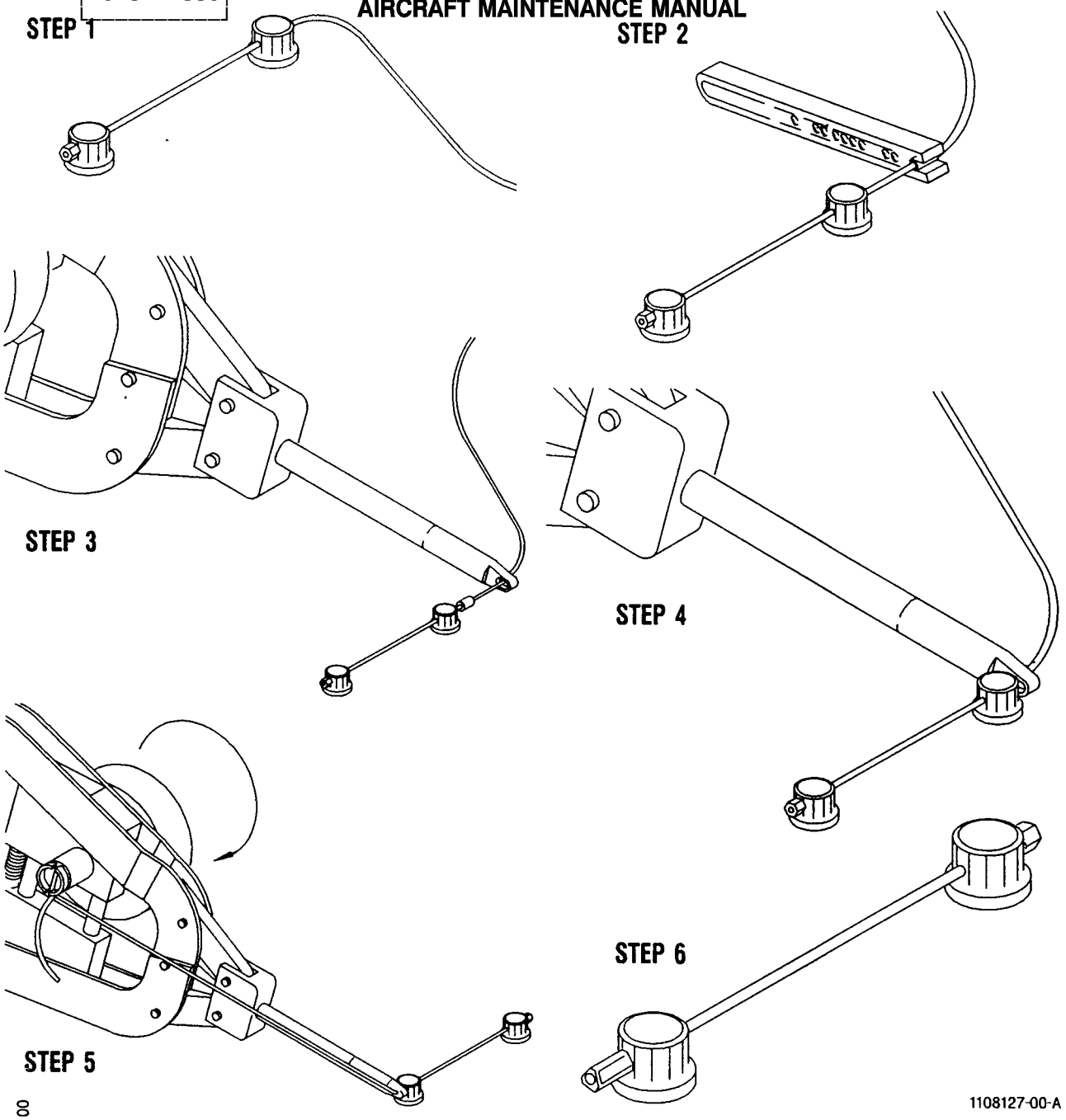
Crimping Tool Verification Equipment
Figure 211



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Bergen Crimping Tool (C10-148) -
Safety Cable Procedure
Figure 212

damage. If the hole is damaged, replace the part or, if possible, use another hole to safety cable (Ref. Fig. 213).

NOTE : Keep the safety cable as straight as possible when you safety cable the fasteners or parts together.

(2)Put the end of the safety cable (C10-145) (without the cable end fitting) into the hole in the part.

(3)Pull the cable through the hole until the cable end fitting is against the part (Ref. Fig. 212) (step 1).

NOTE : Every type of safety cable procedure is not shown in (Ref. Fig. 213). It is necessary, though, that all safety cable procedures must be done generally to the examples shown.

CAUTION : **ON TWO-BOLT PATTERNS, DO NOT SAFETY CABLE IN A NEGATIVE-PULL DIRECTION. MAKE SURE THE CABLE HAS A POSITIVE OR NEUTRAL PULL.**

(4)Insert the end of the cable through the second part.

(5)Choose the hole in the part that permits the cable to be as straight as possible.

(6)Pull the cable through the second part.

(7)If three parts must be safety cabled, do the same procedure for the third part.

(8)Put the end of the safety cable (from the last part to be safety cabled) through a ferrule (C10-144).

(9)Pull the safety cable through the ferrule and use the safety cable to pull the ferrule out of the ferrule magazine (Ref. Fig. 212) (step 2).

(10)Put the end of the safety cable through the crimping head of the crimping tool (C10-148) (Ref. Fig. 212) (step 3).

(11)Make sure the large hole in the crimping head is on the same side as the ferrule.

(12)Move the crimping tool along the safety cable until the crimping head is against the part (Ref. Fig. 212) (step 4).

(13)Make sure the ferrule is fully in the hole in the crimping head.

(14)If the ferrule will not go in the crimping head, do the procedure that follows :

(a)Remove the cable from the crimping tool.

(b)Push the handles together.

NOTE : When the handles are released they will open automatically.

(c)Put the cable back through the crimping head.

(d)Move the crimping tool along the safety cable until the crimping head is against the part.

(e)Make sure the ferrule goes into the hole in the crimping head.

CAUTION : **DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL BREAK THE SAFETY CABLE.**

(15)Put the safety cable across the slotted tensioning wheel on the side of the crimping tool.

(a)Make sure the cable is in the two slots in the wheel that are in line with the crimping head.

(b)Hold the crimping tool perpendicular to the cable. Make sure the ferrule is tightly against the bolt head.

(c)Turn the tensioning wheel on the side of the crimping tool until you hear clicks (Ref. Fig. 212) (step 5).

CAUTION : **DO NOT CRIMP THE FERRULE UNLESS THE CORRECT TENSION IS**

APPLIED BY THE TENSIONING WHEEL. AN INCORRECT CRIMP WILL OCCUR IF THIS IS NOT DONE CORRECTLY.

(d)Apply constant pressure to close the crimping tool handles until the cable is cut.

NOTE : Do not try to remove the crimping tool from the ferrule with handles in the crimped or closed position.
If the handles on the crimping tool are not completely closed when released, the handles will not open.

(e)Release the pressure on the handles.

(f)Remove and discard the unwanted safety cable from the tensioning wheel.

(16)Look at the crimped ferrule to make sure it has a good crimp (Ref. Fig. 212) (step 6).

(17)Do a visual inspection of the safety cable for kinks, frayed wires, or incorrect crimps. Replace the safety cable if a problem occurs.

(18)Remove and discard the unwanted safety cable from the slotted tensioning wheel on the side of the crimping tool.

(19)Push against the safety cable with light finger pressure halfway between the safety cabled parts.

(20)If the cable feels loose, do a dimensional inspection to make sure the safety cable is serviceable as follows (Ref. Fig. 214) :

(a)Measure the distance between the safety-cabled parts. Write this as Dimension A.

(b)If three parts are safety cabled together, measure the distance between each of the parts. Add the two measurements together to get Dimension A.

(c)Push against the safety cable with light finger pressure halfway between two safety-cabled parts.

(d)Measure the distance the safety cable moves laterally in one direction. Write this as Dimension C.

NOTE : If you measure the distance the safety cable moves laterally in the two directions, then write this as Dimension B.

(e)Compare Dimensions A and C to the limits given in (Ref. Fig. 214).

CAUTION : DO NOT TRY TO BREAK THE SAFETY CABLE. IF THE SAFETY CABLE MUST BE REMOVED, CUT THE SAFETY CABLE TO AVOID DAMAGE TO THE HOLES IN THE PARTS.

(21)If the safety cable is not in the limits given in (Ref. Fig. 214) cut the safety cable with side-cushioned diagonal cutter (C10-149). Remove the safety cable.

G. Crimping Tool Verification - Snap-On Tool (C10-148) - Test Block (C10-146) Procedure (Ref. Fig. 215, 216)

NOTE : You can use the safety cable tester (C10-147) as an alternative to this test. Refer to the manufacturer's instuctions.

(1)Do a pulloff load test as often as necessary. You must make sure the crimp is within the limits.

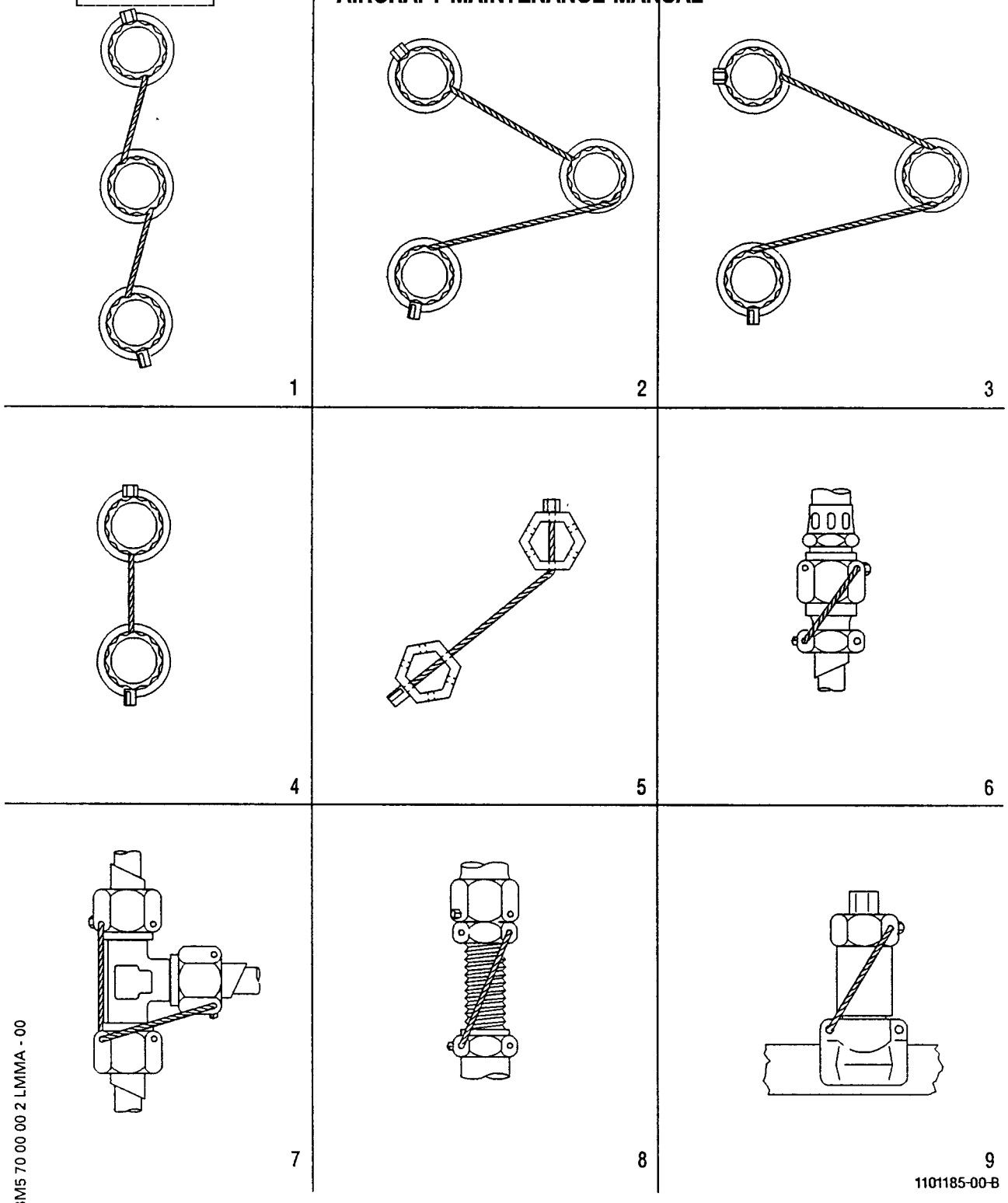
(2)Prepare for the pulloff load test as follows (Ref. Fig. 215, 216).

(a)Set up the test block (C10-146). Refer to the manufacturer's instructions for set up information.

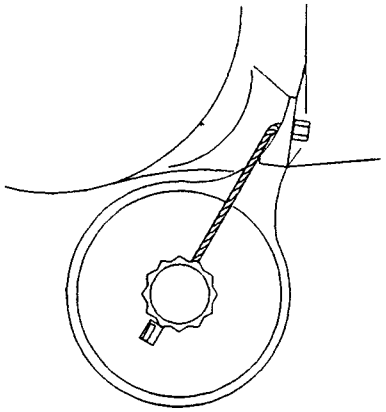
(b)Make sure the pivot joint is in the forward direction.

(c)Move the cable stop at the end of the test block.

(d)Install the safety cable (C10-145) through the cable stop hole.



Safety Cable Patterns (Sheet 1/2)
Figure 213



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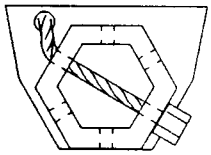

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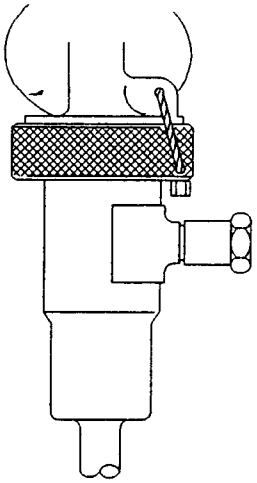

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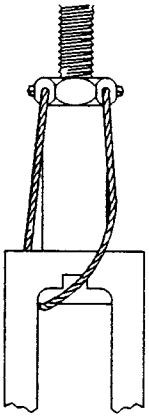

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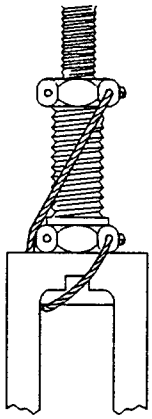
NOTE:

TYPICAL SAFETY CABLE INSALLATION
OF THE VSV ACTUATOR LEVER PUSHROD



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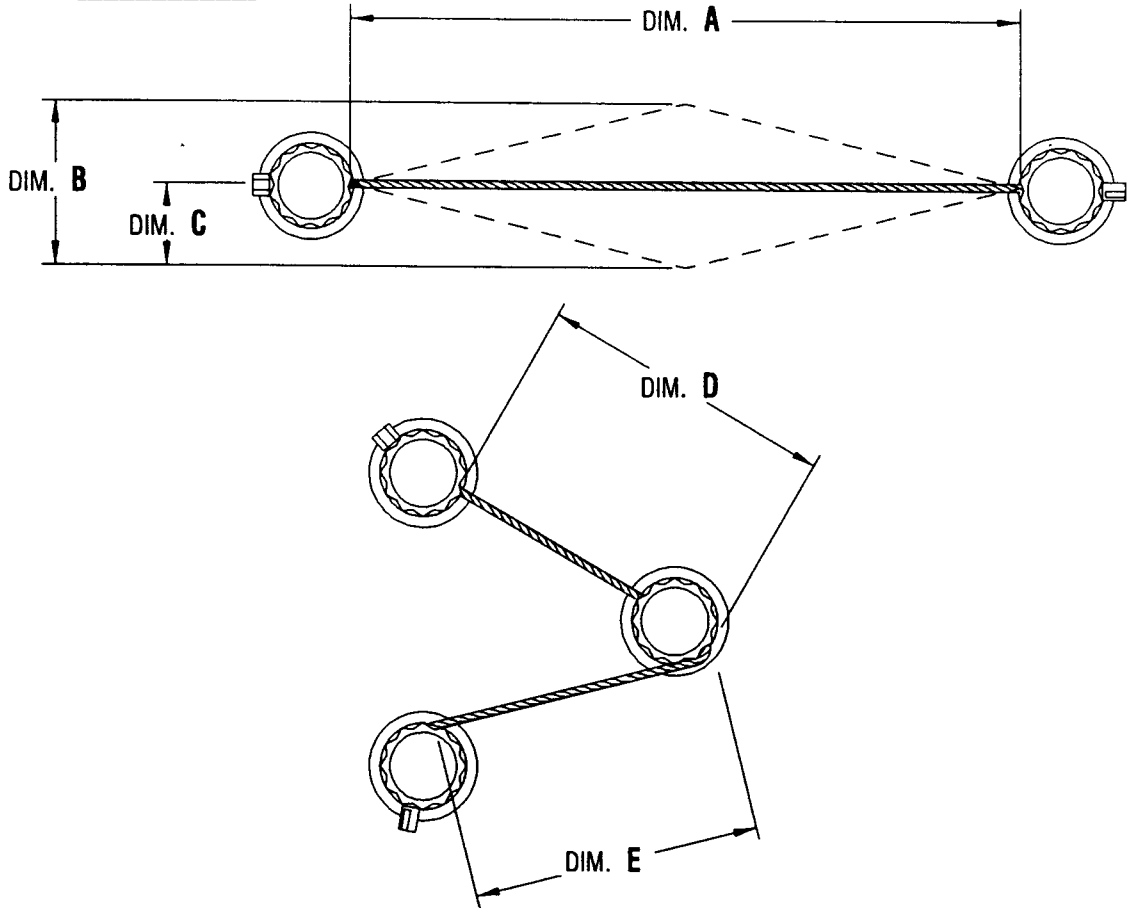
Safety Cable Patterns (Sheet 2/2)
Figure 213



FOR THREE BOLT PATTERNS
DIM. **A** = DIM. **D** + DIM. **E**

DIM. A	DIM. B	DIM. C
0.5 IN. (13 MM)	0.125 IN. (3.18 MM)	0.062 IN. (1.57 MM)
1.0 IN. (25 MM)	0.250 IN. (6.35 MM)	0.125 IN. (3.18 MM)
2.0 IN. (51 MM)	0.375 IN. (9.53 MM)	0.188 IN. (4.78 MM)
3.0 IN. (76 MM)	0.375 IN. (9.53 MM)	0.188 IN. (4.78 MM)
4.0 IN. (102 MM)	0.500 IN. (12.70 MM)	0.250 IN. (6.35 MM)
5.0 IN. (127 MM)	0.500 IN. (12.70 MM)	0.250 IN. (6.35 MM)
6.0 IN. (152 MM)	0.625 IN. (15.88 MM)	0.312 IN. (7.92 MM)

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Safety Cable Flex Limits
Figure 214

(e)Pull the safety cable through the cable stop hole.
(f)Put the safety cable through the hole in the pivot joint and pull the cable through the hole.
(g)Put the end of the safety cable (from the pivot joint) through a ferrule (C10-144) in the ferrule magazine.
(h)Pull the safety cable through the ferrule. Use the safety cable to pull the ferrule out of the ferrule magazine (Ref. Fig. 217) (step 2).
R (j)Put the end of the safety cable through the crimping head of the crimping tool (C10-148) (Ref. Fig. 217) (step 3).
R (k)Make sure the large hole in the crimping head is on the same side as the ferrule.
R (l)Move the crimping tool along the safety cable the safety cable until the crimping head is against the ferrule (Ref. Fig. 217) (step 4).
R (m)Pull on the retraction knob (Ref. Fig. 217) (step 5).
R (n)Put the crimping head on the ferrule and release the retraction knob (Ref. Fig. 217) (step 5).
R (p)Make sure the ferrule is fully in the crimping head (Ref. Fig. 217) (step 5).
R (q)Pull the safety cable through the tension block (Ref. Fig. 217) (step 5).
R (r)Make sure the safety cable is in the groove in the tension post (Ref. Fig. 217) (step 5).

CAUTION : DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL CAUSE UNNECESSARY STRESS ON THE SAFETY CABLE.

R (s)Hold the crimping tool perpendicular to the cable in the bolt head.
R (t)Make sure the ferrule is tightly against the bolt head.
R (u)Lightly pull on the end of the safety cable to remove slack (Ref. Fig. 217) (step 5).
R (v)Push the start cycle button.

NOTE : At the start of the cycle, the tension block will move rearward. This movement rearwards gives the cable tension.

R (w)Turn the drive handle clockwise and release the start cycle button.
R (x)Turn the drive handle until it stops (about two full turns).
R (y)Pull up on the end of the safety cable to remove it from the tension block.
R (aa)Pull on the retraction knob. Remove the crimping tool from the crimped ferrule and the remaining safety cable.
R (ab)Use the side-cushioned diagonal cutters (C10-149) and cut the unwanted safety cable flat with the crimped ferrule (Ref. Fig. 217) (step 6). Discard the safety cable end.
R (ac)Do a finger-pressure test as follows (Ref. Fig. 216) :
1 Find the center of the safety cable in the test block.
2 Use light finger pressure and push the center of the safety cable to the wall on the test block. The safety cable must not touch the wall.
R (ad)If the safety cable does not touch the wall, then the safety cable is serviceable. Do the pulloff load test in paragraph G.(3).
R (ae)If the safety cable touches the wall, the safety cable is not serviceable.
1 Cut the safety cable with side-cushioned diagonal cutter (C10-149)

and remove the safety cable from the test block.

2 Install a new safety cable and do steps G.(2)(a) thru G.(2)(aa) again.

3 Do a check to make sure of a serviceable crimp as follows:
- Make sure the tension on the safety cable is correct.
- When you crimp the ferrule, hold the crimping tool perpendicular to the safety cable.
- Make sure the ferrule is tightly against the bolt head.

4 If the safety cable touches the wall again, do not use the crimping tool.

(3)Do the pulloff load test as follows (Ref. Fig. 216):
(a)Set a calibrated breakaway torque wrench to 70 lbf.in (0.79 m.daN).
(b)Install the torque wrench in the pivot joint on the test block (C10-146) (Ref. Fig. 216).
(c)Move the torque wrench handle counterclockwise until the torque wrench clicks or the ferrule moves.
(d)If the ferrule moves before you hear the torque wrench click, remove the crimping tool from service.

(4)Do the finger-pressure test again (Ref. Fig. 216).
(a)Find the center of the safety cable in the test block.
(b)Use light finger pressure and push the center of the safety cable to the wall on the test block.
(c)If the safety cable does not touch the wall you can use the crimping tool (C10-148).
(d)If the safety cable touches the wall, do not use the crimping tool (C10-148).

(5)Do a test to find the amount of pressure necessary to cause the crimped ferrule or safety cable to break.
(a)It is recommended that this test be done a minimum of one time each month.
(b)Use a safety cable tester (C10-147) to do this test (Ref. Fig. 216). Refer to the manufacturer's instructions.
(c)This test can also be used as an alternative to the test block (C10-146) test (Ref. Step G.).

H. Safety Cable Installation - Snap-On Crimping Tool (C10-148)

(1)Do a visual inspection of the holes to be safety cabled to find all damage. If the hole is damaged, replace the part or if possible, use another hole to safety cable (Ref. Fig. 213).

NOTE : Keep the safety cable as straight as possible when you safety cable the fasteners or parts together.

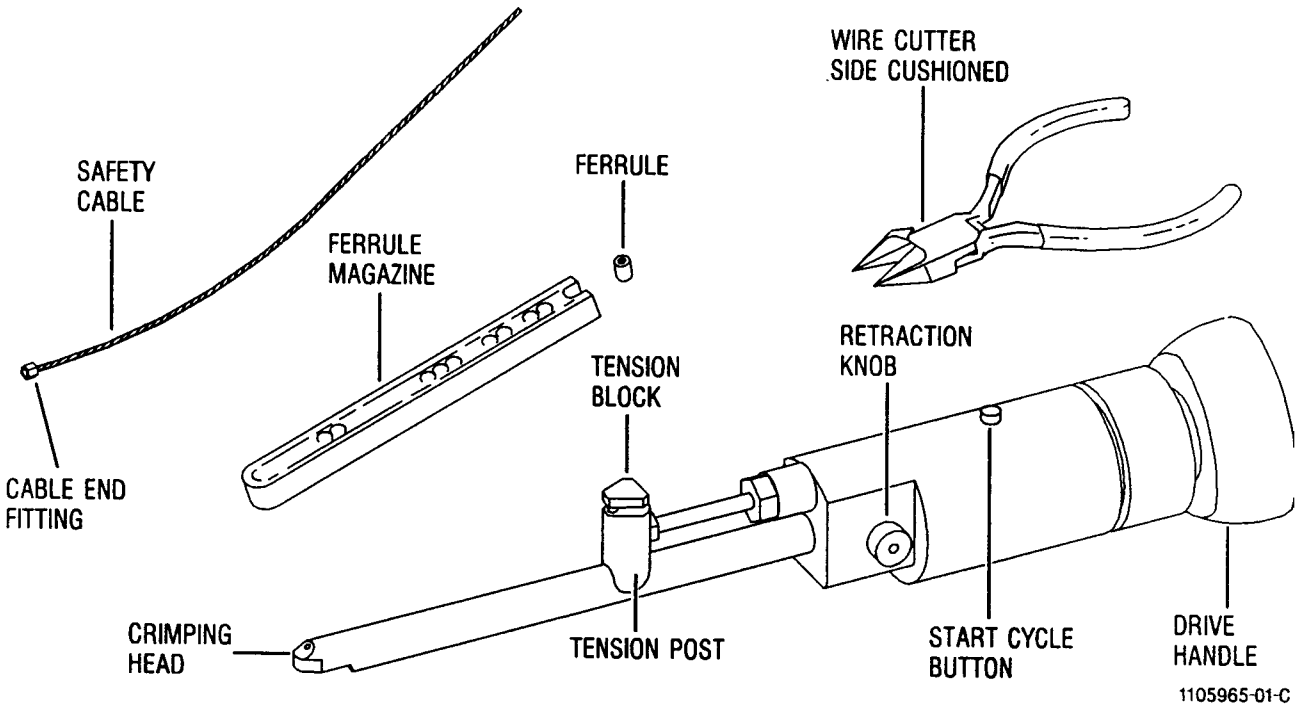
(2)Put the end of the cable (C10-145) (without the cable end fitting) into the hole in the part.

(3)Pull the cable through the hole until the cable end fitting is against the part (Ref. Fig. 217) (step 1).

NOTE : Every type of safety cable procedure is not shown in (Ref. Fig. 213). It is necessary, though, that all safety cable procedures must be done generally to the examples shown.

CAUTION : ON TWO-BOLT PATTERNS, DO NOT SAFETY CABLE IN A NEGATIVE-PULL DIRECTION. MAKE SURE THE CABLE HAS A POSITIVE OR NEUTRAL PULL.

(4)Insert the end of the cable through the second part.



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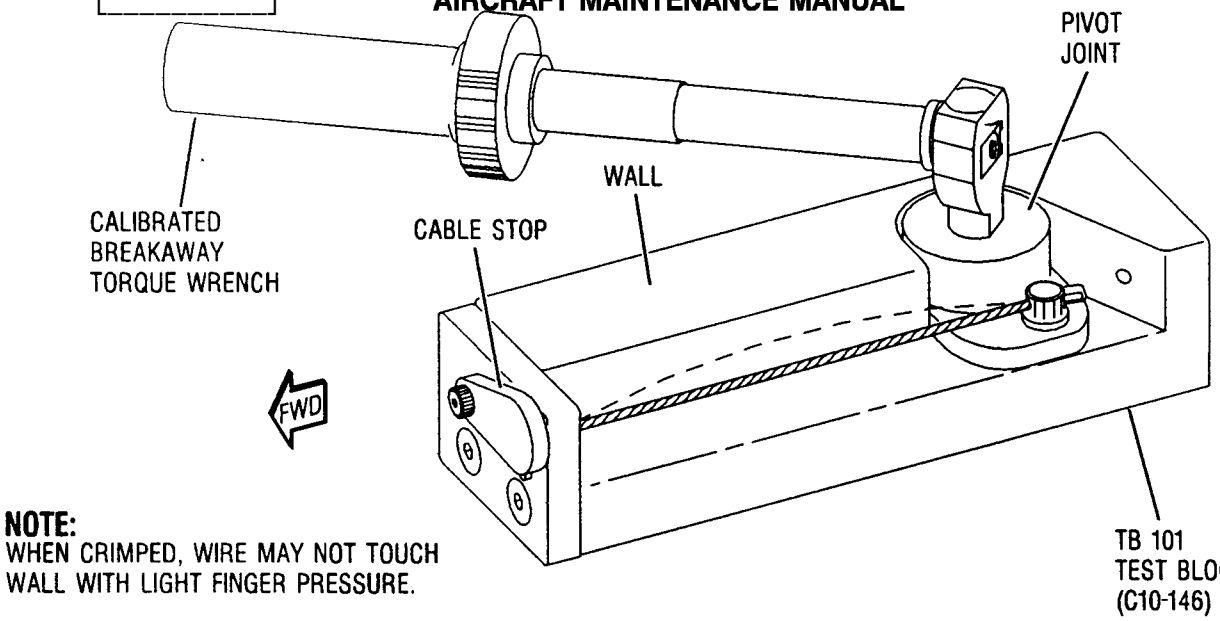
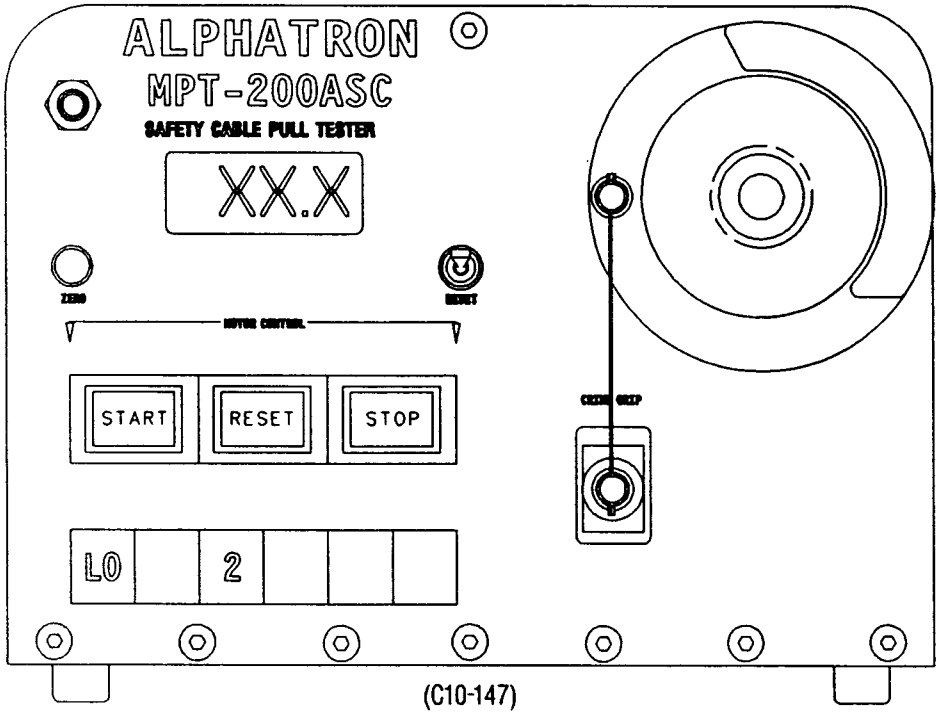
Snap-on Crimping Tool (C10-148) -
Safety Cable Components
Figure 215



NOTE:
WHEN CRIMPED, WIRE MAY NOT TOUCH WALL WITH LIGHT FINGER PRESSURE.



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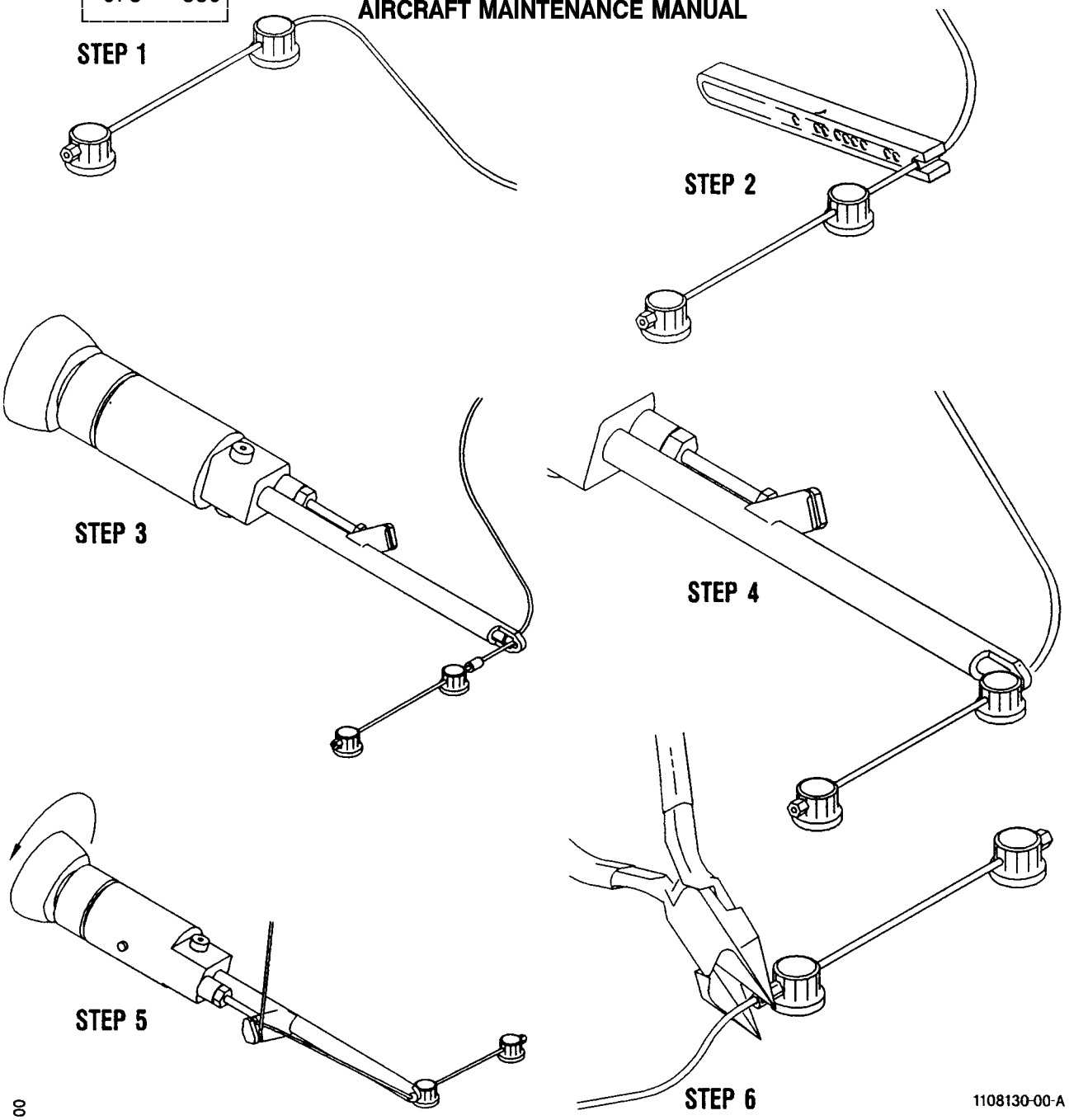
Crimping Tool Verification Equipment
Figure 216



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Snap-on Crimping Tool (C10-148) -
Safety Cable Components
Figure 217

(5)Choose the hole in the part that permits the cable to be as straight as possible.
(6)Pull the cable through the second part.
(7)If three parts must be safety cabled, do the same procedure for the third part.
(8)Put the end of the safety cable (from the last part to be safety cabled) through a ferrule (C10-144).
(9)Pull the safety cable through the ferrule and use the safety cable to pull the ferrule out of the ferrule magazine (Ref. Fig. 217) (step 2).
(10)Put the end of the safety cable through the crimping head of the crimping tool (C10-148) (Ref. Fig. 217) (step 3).
(11)Make sure the large hole in the crimping head is on the same side as the ferrule.
(12)Move the crimping tool along the safety cable until the crimping head is against the ferrule.
(13)Pull on the retraction knob (Ref. Fig. 217) (step 5).
(14)Put the crimping head on the ferrule and release the retraction knob (Ref. Fig. 217) (step 5).
(15)Make sure the ferrule is fully in the crimping head (Ref. Fig. 217) (step 5).
(16)Pull the safety cable through the tension block (Ref. Fig. 217) (step 5).
(17)Make sure the safety cable is in the groove in the tension post (Ref. Fig. 217) (step 5).

CAUTION : DO NOT PUT TOO MUCH TENSION ON THE SAFETY CABLE. THE CRIMPING TOOL WILL AUTOMATICALLY SET THE TENSION. TOO MUCH TENSION WILL CAUSE UNNECESSARY STRESS ON THE SAFETY CABLE.

(18)Hold the crimping tool perpendicular to the cable in the bolt head.
(19)Make sure the ferrule is tightly against the bolt head.
(20)Lightly pull on the end of the safety cable to remove slack (Ref. Fig. 217) (step 5).
(21)Push the start cycle button.

NOTE : At the start of the cycle, the tension block will move rearward. This movement rearwards gives the cable tension.

(22)Turn the drive handle clockwise and release the start cycle button.
(23)Turn the drive handle until it stops (about two full turns).
(24)Pull up on the end of the safety cable to remove it from the tension block.
(25)Pull on the retraction knob. Remove the crimping tool from the crimped ferrule and the remaining safety cable.
(26)Use the side-cushioned diagonal cutters (C10-149) and cut the unwanted safety cable flat with the crimped ferrule (Ref. Fig. 217) (step 6). Discard the safety cable end.
(27)Do a visual inspection of the safety cable for kinks, frayed wires, or incorrect crimps. Replace safety cable if a problem occurs.
(28)Push against the safety cable with light finger pressure halfway between the safety cabled parts.
(29)If the cable feels loose, do a dimensional inspection to make sure the safety cable is serviceable as follows (Ref. Fig. 214).
(a)Measure the distance between the safety-cabled parts. Write this as Dimension A.

(b)If three parts are safety cabled together, measure the distance between each of the parts. Add the two measurements together to get Dimension A.

(c)Push against the safety cable with light finger pressure halfway between two safety cabled parts.

(d)Measure the distance the safety cable moves laterally in one direction. Write this as Dimension C.

NOTE : If you measure the distance the safety cable moves laterally in the two directions, then write this as Dimension B.

(e)Compare Dimenions A and C to the limits given in (Ref. Fig. 214).

CAUTION : DO NOT TRY TO BREAK THE SAFETY CABLE. IF THE SAFETY CABLE MUST BE REMOVED, CUT THE SAFETY CABLE TO AVOID DAMAGE TO THE HOLES IN THE PARTS.

(30)If the safety cable is not in the limits given in (Ref. Fig. 214) cut the safety cable with side-cushioned diagonal cutter (C10-149). Remove the safety cable.

R J. Cotter Pin Practices (Ref. Fig. 218)

CAUTION : DO NOT EXCEED MAXIMUM TORQUE WHEN TIGHTENING FASTENERS.

(1)Tighten the castellated nut to the low side of the specified torque range, and continue tightening until a slot aligns with the hole in the bolt shank.

CAUTION : COTTER PINS ARE NOT REUSABLE. USE NEW COTTER PINS FOR EACH ASSEMBLY.

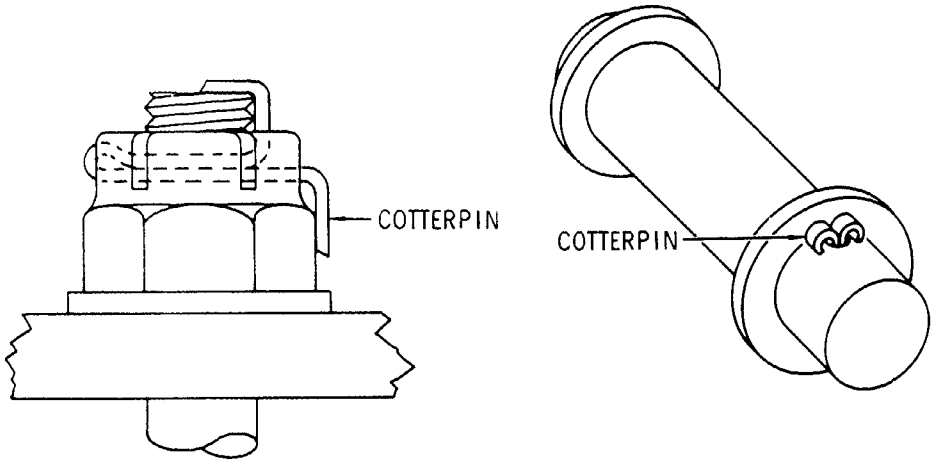
(2)Install the cotter pin with the head seated firmly in the slot of the nut. Bend prongs of cotter pin so that the head and upper prong are firmly seated against the bolt.

R K. Tab Washer Practices (Ref. Fig. 219)

CAUTION : TAB WASHERS ARE NOT REUSABLE. USE NEW TAB WASHERS FOR EACH ASSEMBLY.

(1)Install tab washer so that the locking tab is butted against any tendency to untighten.

(2)Bend the locking tab snugly against flat of nut (Ref. Fig. 219) for correct and incorrect method of bending.



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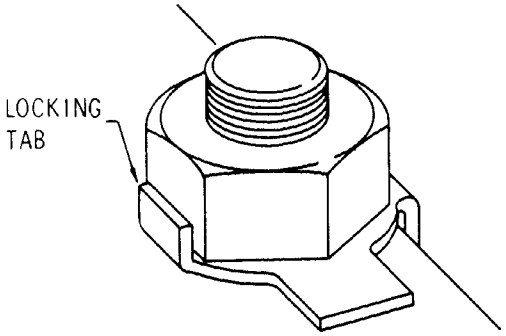
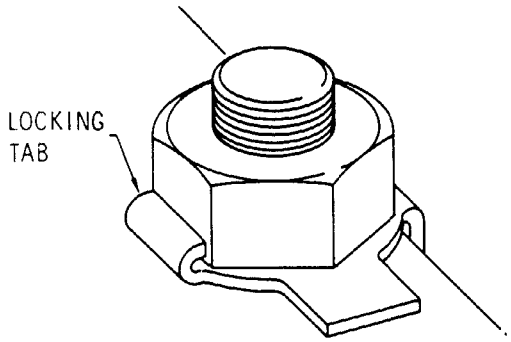
Cotter Pin Locking
Figure 218



CORRECT



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Tab Washer Locking
Figure 219

4. Tri-Wing Fasteners

A. General
Tri-Wing recessed-head fasteners are available in a wide range of sizes, and each size requires the use of a matched driver (Ref. Fig. 220). When properly used, the Tri-Wing design permits a higher ratio of torque to end-pressure than is possible with slotted-head or cross-head designs ; hence, burring and mutilation are minimized, and both tool - and part-reusability are increased. If the fastener should become seized because of corrosion or other conditions, the head design forms a built-in center which permits drilling out without risking damage to surrounding surfaces.

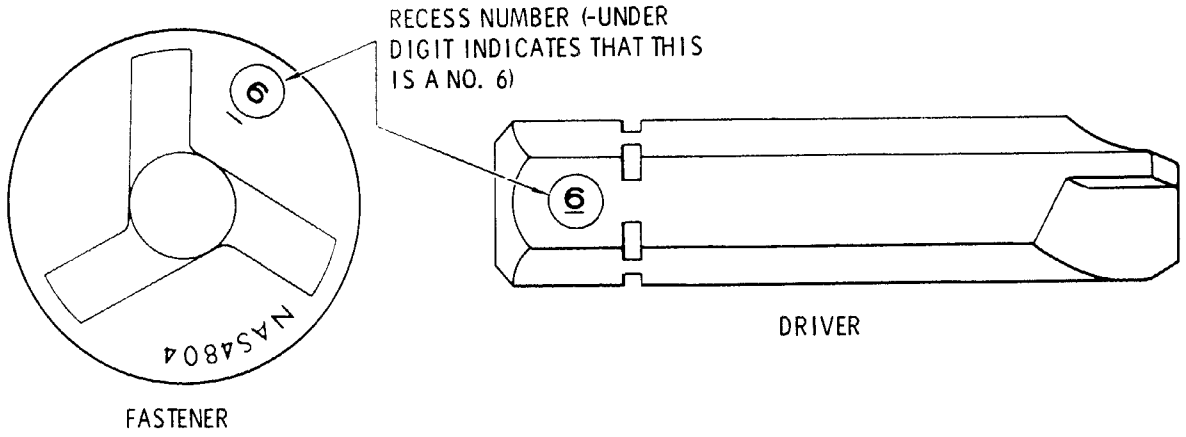
B. Equipment
A complete selection of drivers is recommended, to provide maximum adaptability to the Tri-Wing fastener system. In addition to straight drivers, offset and universal-joint drivers and hand screwdrivers with screwholders are available.

C. Driver Selection
CAUTION : MAKE CERTAIN THAT AXIS OF DRIVE IS ALIGNED WITH AXIS OF FASTENER WHEN INSTALLING OR REMOVING FASTENER.
(1)Select the correct driver. The driver number should match the recess number of the fastener head as shown (Ref. Fig. 220, 221) lists a range of standard fastener sizes with their corresponding Tri-Wing recess identification numbers.
(2)If the head of the fastener has been coated with paint or other material, use a driver one size smaller than that indicated, to compensate for the thickness of material on the walls of the recess.

D. Extraction
(1)There is no slope to the walls of mating surfaces of either fastener or driver, so that the tendency of the driver to "cam out" of the recess is minimized ; therefore, normal extraction by applying counterclockwise torque is usually successful.
(2)If corrosion or other factors have caused the fastener to seize so that failure of the recess occurs, select the proper drill and screw extractor for the size of fastener involved. The bottom of the fastener recess is shaped so that the drill centers itself naturally, and no special drilling procedure is required. Drill into the fastener deep enough to provide sufficient working depth for the screw extractor. Tap the extractor to seat it firmly, then apply counterclockwise torque to remove the fastener.

5. Marking Practices

A. General
(1)Identification of parts, assemblies, subassemblies, modules and/or engines is achieved by marking at the time of manufacture. The type and location of marking is determined by the size, shape, material, environment, function, etc., of the part.
(2)There are 2 categories of marking : permanent and temporary.



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Tri-Wing Fasteners and Drive Configuration
Figure 220

TRI-WING DRIVERS AND STANDARD-THREAD FASTENERS					
SCREW THREAD SIZE	TENSION HEAD	SHEAR HEAD	SCREW THREAD SIZE	TENSION HEAD	SHEAR HEAD
0 - 80	0	--	3/8 - 24	8	7
2 - 56	1	--	7/16 - 20	9	8
4-40	2	1	1/2 - 20	10	9
6 - 32	3	2	9/16 - 18	11	10
8 - 32	4	3	5/8 - 18	12	11
10 - 32	5	4	3/4 - 16	13	12
1/4 - 28	6	5	7/8 - 14	14	13
5/16 - 24	7	6	1 - 12	15	14

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Tri-Wing Recess Number Table
Figure 221

(a)Permanent marking normally will imprint the part with the required information and is intended to remain legible through engine operation and maintenance procedures.
(b)Temporary marking is accomplished by applying or adding some material to the surface of the part. Temporary marking is not intended to withstand engine operation and is normally removed during or following maintenance procedures.

(3)Many engine parts are exposed to high temperature environments during use or maintenance. Improper marking may be obliterated by high temperature and the part identification lost. Chemical attack from marking materials exposed to high temperature may corrode the part and lead to possible part failure.

(4)Some marking methods require deep impressions in the part, causing local stresses. The use of these marking methods must be carefully considered relative to the tolerance of the part to these stresses. These marking methods are the most permanent, however, and are frequently utilized.

B. Permanent Marking

(1)Permanent marking of part is often required when parts are modified during maintenance and the part identification is changed. Permanent marking may also be used to monitor part life or history.

(2)The method and location of permanent marking must be selected so as not to cause damage to the part.

(3)Application

Typical uses for permanent marking are :

(a)Part number identification change following a modification of the part.
(b)Indicate compliance to service bulletins.
(c)Indicate repairs completed.
(d)Indicate the number of heat treat cycles on part.
(e)Indicate the accumulated hours or cycles on part.
(f)Indicate position marking for aid in assembly.

(4)Marking Methods

Whenever permanent marking is required, the method and location are usually specified in the Engine/Shop Manual. When marking instructions are not specified or the method and/or location is not available, the following recommendations should be followed.

(a)Mark in low-stress areas.
(b)Do not mark on any surface which contacts another surface during assembly or operation such as flange mating surfaces or other areas subject to possible contact or wear.
(c)Do not mark on surfaces exposed to the primary gas flow of the engine.
(d)Do not remove or totally obliterate existing markings, but line-out or mark through existing marking so that it remains legible.
(e)Make new marking adjacent to, or in the same area as existing marking.
(f)Make new marking on the same surface as existing marking.
(g)Make new marking by the same method and same size characters as the existing marking.
(h)Do not use impression type marking which could cause deformation of part or reduce wall thickness on thin walled parts.
R (j)Do not use impression type marking on parts made from titanium alloy.

C. Temporary Marking

Temporary marking is used for temporary identification purposes. This is accomplished by the attachment of tags or adhesive labels or marking directly on the part. Temporaty marking is usually removed prior to assembly or operation of the engine. The materials selected, however, should be chosen so that failure to remove the marking will not cause damage or failure of the parts so marked.

(1)Application

Typical uses for temporary marking area :

(a)Indicating location of defects during inspection.

(b)Indicating relative position of parts in an assembly by sequential numbering or matchmarks.

(c)Identifying the subassembly, module, or engine the part may be assigned to or removed from.

(d)Identifying shop operations or inspections performed or to be performed.

(2)Marking methods

Whenever temporary marking is required, the method and location are usually specified in the Engine/Shop Manual. When marking instructions are not specified or the method and/or location not available, the following recommendations should be followed :

(a)Metal tags must be made from stainless steel and held to part with stainless steel wire.

(b)Adhesive on tape or labels must be approved by suitability tests to ensure against corrosion to parts when subjected to high temperature.

(c)Marking ink, pencils, paints, etc., must be approved by suitability test to ensure against corrosion to parts when subjected to high temperature.

6. Tightening Practices and Torque Values

A. General

(1) This standard practice details the methods, terms, and procedures used in tightening and applying torque to threaded fasteners such as, bolts, nuts, and fittings.

(2) Torque in pound-inches (lbf.in.) or meter deca Newtons (M.daN), is the specific twisting force applied to threaded fasteners to obtain optimum security of the part, within the tensile limits of the material, or the shear limits of the threads of the fastener. One lbf. in. (m.daN) is the twisting force of one pound (0.45 kg) applied to a lever one in. (25.4 mm) long. Higher torque values are equal to the product of the pounds (kilograms) times the length of the lever in inches (millimeters).

NOTE : Torque (twisting force) is expressed in lbf. in. (m.daN) to distinguish it from force applied in a straight line (work), which is expressed as inch-pounds (in. lbf.), foot-pounds (ft lbf), or joules (J). One ft lbf (J) of work is defined as the amount of energy required to lift an object having one pound (0.45 kg) of mass through a distance of one foot (0.305 m).

B. Definition of Terms

(1) Bolt

For purposes of these definitions, any male-threaded part.

(2) Breakaway torque

The torque required to just start an installed nut moving off the bolt, with no axial load on the bolt. (Nut is not seated, but is stationary at initiation of torque).

(3) Gross torque

The actual indicated torque applied by the torque wrench, including run-on torque and seating torque.

(4) Installed nut

A nut is defined as installed on a bolt when not less than chamfer plus one and a half threads of the bolt extend beyond the nut. Nuts that have midlength nylon inserts or other centralized locking devices do not require the bolt to protrude from the nut, as long as the bolt passes through the locking device by the chamfer plus one and a half threads.

(5) Maximum installation torque

The highest value obtained as the nut is initially installed, and is being sized (opened up or worn in) by the bolt.

(6) Minimum prevailing torque

The minimum value obtained while the nut or bolt is in motion from the end of the first revolution to the end of the second revolution during the removal of the nut from the bolt, or the bolt from a threaded hole.

(7) Removed nut

A self-locking nut is defined as removed when the locking section is disengaged from the bolt. (The nut need not be physically removed from the bolt).

(8) Run-on torque

The torque required to turn a nut or bolt before it is completely seated to perform an axial tightening action on the bolt or spacing elements.

(9) Seated nut bolt

The torque that applies as a specified compressive force to the spacing elements, or an axial loading or elongating force to a bolt, after the bearing surfaces of the bolt and/or nut are in contact with the spacing elements.

(10)Spacer, spacing elements
For purposes of these definitions, any parts, regardless of function, size, shape, or material that are held together by one or more threaded fasteners.

(11)Unseated nut bolt
A nut or bolt is defined as unseated when it is removed a minimum of one turn from the seated position, removing any axial load from the bolt.

(12)Unseated torque
The torque required to unseat the bearing surface of a nut or bolt from a spacer, removing all axial load from the bolt.

C. Tightening Procedure

CAUTION : **WHEN ASSEMBLY REQUIRES HEATING OR CHILLING PARTS, DO NOT TIGHTEN RETAINING NUTS OR BOLTS TO FINAL TORQUE VALUES UNTIL THE PARTS HAVE RETURNED TO ROOM TEMPERATURE. IF THE PART HAS BEEN HEATED, THE FASTENER MAY LOOSEN AS THE PART COOLS. IF THE PART HAS BEEN CHILLED, THE FASTENER MAY BE OVERSTRESSED AS THE PART EXPANDS. PARTS MAY BE SEATED BY TIGHTENING NUTS OR BOLTS PROVIDING FASTENERS ARE LOOSENED UNTIL PARTS HAVE RETURNED TO ROOM TEMPERATURE.**

(1)Tighten at a uniform rate until the specified torque is obtained. In some cases, where gaskets or other parts cause a slow permanent set, be sure to check the torque at the desired value after the material is seated.

(2)Do not tighten to the final torque value during the first drawdown ; uneven tension can cause distortion or overstressing of parts. Seat mating parts by drawing down the bolts in gradual increments, following a staggered or diametrically opposite sequence, until the parts are firmly seated. Complete the tightening procedure by loosening each fastener separately, then tighten to the specified torque value. Do not exceed the maximum torque values specified by the engine manual.

D. Torque Wrench Sizes

(1)This standard practice does not cover the use of torque multipliers to obtain higher torque values. Information regarding the operation of such equipment can be found in the manufacturer's literature.

(2)The torque wrenches listed below are recommended for use within the indicated ranges. Larger wrenches have a wider tolerance, and their use can result in serious inaccuracies.

Torque Wrench Size	Torque Limits	Tolerances
30 lbf. in.	0-25 lbf. in. (0.000 - 0.28 m.daN)	± 1 lbf. in. (0.01 m.daN)
150 lbf. in.	26-140 lbf. in. (0.29 - 1.58 m.daN)	± 5 lbf. in. (0.06 m.daN)
600 lbf. in.	141 - 550 lbf. in.	± 20 lbf. in.

Torque Wrench Size	Torque Limits	Tolerances
	(1.59 - 6.21 m.daN)	(0.23 m.daN)
1800 lbf. in.	360 - 1680 lbf. in. (4.09 - 18.98 m.daN)	± 60 lbf. in. (0.68 m.daN)
3000 lbf. in.	1692 - 2880 lbf. in. (19.12 - 32.54 m.daN)	± 120 lbf. in. (1.36 m.daN)
12000 lbf. in.	2892 - 12000 lbf. in. (32.68 - 135.58 m.daN)	± 240 lbf. in. (2.71 m.daN)

E. Use of Offset Extension Wrench (Ref. Fig. 222)

(1)When an offset extension wrench, such as a crowfoot extension, is used with a torque wrench, the effective length of the torque wrench is changed. The torque wrench is so calibrated that when an extension wrench is used, the indicated torque, the value that appears on the scale or dial of the torque wrench, may be different from the actual torque that is applied to the nut or bolt.

(2)The method of computing the adjustment is as follows :

(a)The addition or subtraction of the effective length of the crowfoot extension (E) is determined by its position on the torque wrench (L). When the extension wrench is pointed in the same direction as the torque wrench, add the effective length of the extension to the effective length of the torque wrench (L + E). When the extension is pointed back toward the handle of the torque wrench, subtract the effective length of the torque wrench (L - E). When the extension is pointed at right angles to the torque wrench, the effective length does not change. The effective length (L) of the torque wrench is predetermined by the torque wrench manufacturer. Refer to manufacturer's specification for the particular torque wrench being used. The effective length (E) of the crowfoot extension is determined by measuring from the center of the drive opening to the center of the wrench opening.

(b)Multiply the required torque (T) by the effective length of the torque wrench (L). Divide this product by (L + E) or (L - E) as determined from (Ref. Fig. 222).
The quotient is the gage or scale reading required to obtain the desired torque.
For example : Required torque = 265 lbf. in. (2.99 m.daN)
Effective length of torque wrench = 8.4 in. (213.36 mm)
Effective length of crowfoot = 1.5 in. (38.1 mm)
Then : (Required Torque) X (L) = 265 X 8.4 =
2226.0 (2.99 m.daN X 213.36 mm = 638.82)
(L + E) = 9.9 in. (251.46 mm)
2226.0/9.9 = 224.85 lbf. in. approximately 225 lbf. in.

638.820/25.146 = 2.54 m.daN

Thus : A gage reading of 225 lbf. in. indicates a required torque of 265 lbf. in. (A gage reading of 2.54 m.daN indicates a required torque of 2.99 m.daN).

F. Standard Torque Values

(1)Steel nuts and bolts. The following lists standard torque values for steel nuts and bolts.

NOTE : Pound.Inches X 0.1129848 or pound.feet X 1.355818=N.m.

Nominal Size	UNC and -8 Series Threads per inch	Torque	UNF and -12 Series Threads per Inch	Torque
No. 6	32	8 - 10 lbf.in. 0.09 - 0.11 m.daN	40	10 - 12 lbf.in. 0.11 - 0.14 m.daN
No. 8	32	13 - 6 lbf.in. 0.15 - 0.18 m.daN	36	16 - 19 lbf.in. 0.18 - 0.21 m.daN
No. 10	24	20 - 23 lbf.in. 0.23 - 0.26 m.daN	32	33 - 37 lbf.in. 0.37 - 0.42 m.daN
No. 12	20	40 - 60 lbf.in. 0.45 - .68 m.daN	28	55 - 70 lbf.in. 0.62 - 0.79 m.daN
5/16	18	70 - 110 lbf.in. 0.79 - 1.24 m.daN	24	100 - 130 lbf.in. 1.13 - 1.47 m.daN
3/8	16	160 - 210 lbf.in. 1.81 - 2.37 m.daN	24	190 - 230 lbf.in. 2.15 - 2.60 m.daN
7/16	14	250 - 320 lbf.in. 2.82 - 3.62 m.daN	20	300 - 360 lbf.in. 3.39 - 4.07 m.daN
1/2	13	420 - 510 lbf.in. 4.75 - 5.76 m.daN	20	480 - 570 lbf.in. 5.42 - 6.44 m.daN
9/16	12	48 - 57 lbf.ft. 6.50 - 7.73 m.daN	18	55 - 65 lbf.ft. 7.46 - 8.81 m.daN
5/8	11	70 - 80 lbf.ft. 9.49 - 10.85 m.daN	18	82 - 95 lbf.ft. 11.12 - 2.88 m.daN
3/4	10	135 - 150 lbf.ft. 18.30 - 20.34 m.daN	16	150 - 165 lbf.ft. 20.34 - 22.37 m.daN
7/8	9	205 - 230 lbf.ft. 27.79 - 31.18 m.daN	14	235 - 265 lbf.ft. 31.86 - 35.93 m.daN

Nominal Size	UNC and -8 Series Threads per inch	Torque	UNF and -12 Series Threads per Inch	Torque
1.000	8	300 - 340 lbf.ft. 40.67 - 46.10 m.daN	14	350 - 400 lbf.ft. 47.45 - 4.23 m.daN
1-1/8	7	415 - 480 lbf.ft. 56.27 - 65.08 m.daN	12	485 - 565 lbf.ft. 65.76 - 76.60 m.daN
1-1/4	7	600 - 700 lbf.ft. 81.35 - 94.91 m.daN	12	690 - 800 lbf.ft. 93.55 - 108.47 m.daN
1-3/8	6	800 - 930 lbf.ft. 108.47 - 126.09 m.daN	12	900 - 1060 lbf.ft. 122.02 - 143.72 m.daN
1-1/2	6	1000 - 1200 lbf.ft. 135.58 - 162.70 m.daN	12	1200 - 1400 lbf.ft. 162.70 - 189.81 m.daN
1-1/8	8	440 - 510 lbf.ft. 59.66 - 69.15 m.daN		
1-1/4	8	625 - 725 lbf.ft. 84.74 - 98.30 m.daN		
1-3/8	8	840 - 1000 lbf.ft. 113.89 - 135.58 m.daN		
1-1/2	8	1150 - 1350 lbf.ft. 155.92 - 183.04 m.daN		

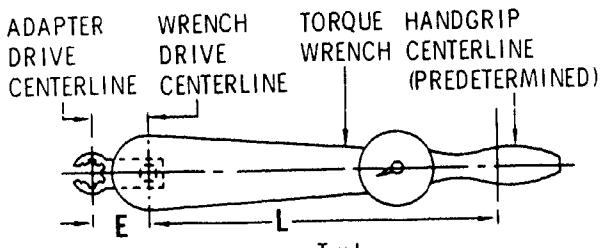
EXCEPTIONS : Use one-half the values given in the above for the following applications.

(1)Thin steel hex nuts. Those nuts having a height of less than 0.6 the pitch-diameter for plain nuts, and less than 0.8 the pitch-diameter for self-locking nuts.

(2)Nuts and bolts of nonferrous alloys.

(2)Studs and stepped studs - aluminum/magnesium. The following lists standard torque values for aluminum or magnesium studs and stepped studs.

Bolt or Stud Size	Pound-inches	Metre - deca newton
3/16 - 24	35 - 40	(0.40 - 0.45)
1/4 - 20	75 - 80	(0.85 - 0.90)
5/16 - 18	135 - 145	(1.53 - 1.64)
3/8 - 16	240 - 250	(2.71 - 2.82)
7/16 - 14	370 - 380	(4.18 - 4.29)
1/2 - 13	580 - 600	(6.55 - 6.78)

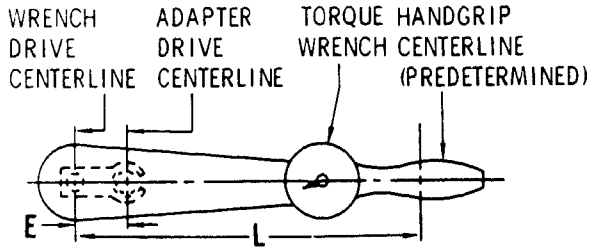


FORMULA $\frac{T \times L}{L + E} = Y$

EXAMPLE: (WITH "E" AS PLUS DIMENSION)

$Y = \frac{135 \times 10}{10 + 1.5} = \frac{1350}{11.5} = 117.39$

T = 135 LB IN. L = 10.0 IN. Y = 117 LB IN.
Y = UNKNOWN E = 1.5 IN.



FORMULA $\frac{T \times L}{L - E} = Y$

EXAMPLE: (WITH "E" AS MINUS DIMENSION)

$Y = \frac{135 \times 10}{10 - 1.5} = \frac{1350}{8.5} = 158.82$

T = 135 LB IN. L = 10.0 IN. Y = 159 LB IN.
Y = UNKNOWN E = 1.5 IN.

LEGEND:
T = ACTUAL (DESIRED) TORQUE
Y = APPARENT (INDICATED) TORQUE
L = EFFECTIVE LENGTH LEVER
E = EFFECTIVE LENGTH OF EXTENSION

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Use of Offset Extension Wrench
Figure 222

NOTE : Studs that have different threads on opposite ends shall be tightened to the torque applicable to the small size.

(3)Ferruled fittings. The following lists standard torque values for ferruled fittings.

Tube OD (in)	Thread Size (in) - (number)	All Aluminum Parts (Note 1)	Steel Tube Aluminum or Steel Nuts (Note 2)	Torque Units
1/8	5/16 - 24	0 - 0	40 - 50	lbf.in.
		0.00 - 0.00	0.45 - 0.56	m.daN
3/16	3/8 - 24	30 - 50	90 - 100	lbf.in
		0.34 - 0.56	1.02 - 1.13	m.daN
1/4	7/16 - 20	40 - 65	135 - 150	lbf.in.
		0.45 - 0.73	1.53 - 1.69	m.daN
5/16	1/2 - 20	60 - 80	180 - 200	lbf.in.
		0.68 - 0.90	2.03 - 2.26	m.daN
3/8	9/16 - 18	75 - 125	270 - 300	lbf.in.
		0.85 - 1.41	3.05 - 3.39	m.daN
1/2	3/4 - 16	150 - 200	45 0 - 550	lbf.in.
		1.69 - 2.26	5.08 - 6.21	m.daN
5/8	7/8 - 14	200 - 300	650 - 770	lbf.in.
			54 - 64	lbf.ft.
		2.26 - 3.39	7.34 - 8.70	m.daN
3/4	1-1/16 - 12	300 - 425	900 - 1100	lbf.in.
		25 - 35	75 - 91	lbf.ft.
		3.39 - 4.80	10.17 - 12.43	m.daN
1.000	1-5/16 - 12	490 - 700	1340 - 1540	lbf.in.
		41 - 58	112 - 128	lbf.ft.
		5.54 - 7.91	15.14 - 17.40	m.daN
1-1/4	1-5/8 - 12	600 - 900	1600 - 1800	lbf.in.
		50 - 75	133 - 150	lbf.ft.
		6.78 - 10.17	18.08 - 20.34	m.daN
1-1/2	1-7/8 - 12	600 - 900	1900 - 2200	lbf.in.
		50 - 75	158 - 183	lbf.ft.
		6.78 - 10.17	21.47 - 24.86	m.daN

NOTE 1 : These values apply when female sealing surface is aluminum. Male

connector and nut may be steel or aluminum.

NOTE 2 : The values apply when flared tube brazed ferrule and connector are steel. Male-end fitting and nut may be steel or aluminum.

(4)Plugs and tube fittings. The following lists standard torque values for plugs and tube fittings.

Fitting Size	Thread Size (in) (pitch)	Torque Value	Torque Unit
-2	5/16 - 24	40 - 50	lbf.in.
		0.45 - 0.56	m.daN
-3	3/8 - 24	90 - 100	lbf.in.
		1.02 - 1.13	m.daN
-4	7/16 - 20	135 - 150	lbf.in.
		1.53 - 1.69	m.daN
-5	1/2 - 20	155 - 175	lbf.in.
		1.75 - 1.98	m.daN
-6	9/16 - 18	180 - 200	lbf.in.
		2.03 - 2.26	m.daN
-8	3/4 - 16	270 - 300	lbf.in.
		3.05 - 3.39	m.daN
-10	7/8 - 14	360 - 400	lbf.in.
		4.07 - 4.52	m.daN
-12	1-1/16 - 12	540 - 600	lbf.in.
		45 - 50	lbf.ft.
		6.10 - 6.78	m.daN
-16	1-5/16 - 12	700 - 850	lbf.in.
		58 - 70	lbf.ft.
		7.91 - 9.60	m.daN
-20	1-5/8 - 12	900 - 1050	lbf.in.
		75 - 87	lbf.ft.
		10.17 - 11.86	m.daN
-24	1-7/8 - 12	1000 - 1200	lbf.in.
		83 - 100	lbf.ft.
		11.30 - 13.56	m.daN

(5)Hemsworth fittings. The following lists torque values for hemsworth fittings.

TUBE SIZE	TORQUE (Pound-feet)	TORQUE (Newton-meters)
0.75 - 1.0	24 - 26	32.5 - 35.3
1.125 - 1.5	30 - 40	40.7 - 54.2
1.625 - 2.0	40 - 50	54.2 - 67.8

G. Tightening of Plugs and Tube Fittings (Ref. Fig. 223)

(1)Assembly techniques vary, depending upon the specific type of plug or tube fitting being used. The types normally encountered include nonpositioning plugs and unions, using preformed packing or other compressible packing for seals ; positioning fittings, with or without backup washers ; and universal bulkhead fittings, held in position by locknuts.

(2)Correct assembly techniques

R CAUTION : APPLY ONLY ENOUGH LUBRICANT TO WET THE SURFACE OF THE PREFORMED
R PACKING AND ADJACENT SURFACE.
R TOO MUCH LUBRICANT CAN CAUSE CONTAMINATION WHICH CAN CAUSE
R LEAKS.
R CAUTION : USE A PROTECTIVE DEVICE WHEN YOU INSTALL PREFORMED PACKINGS
R OVER THREADS OR SHARP CORNERS OR DAMAGE TO THE PREFORMED
R PACKING CAN OCCUR.
R CAUTION : DO NOT USE SHARP OR POINTED TOOLS TO REMOVE THE PREFORMED
R PACKINGS OR DAMAGE TO THE PREFORMED PACKING SEALING SURFACE CAN
R CAN OCCUR.

(a)Installation of preformed packing on fittings

1 When ratio of preformed packing diameter to cross-section is greater than 20, use a conic sleeve screwed onto fitting so that preformed packing may be rolled into groove of fitting without danger of being damaged.

2 For diameter ratios less than 20, a conic sleeve is not needed, except when the preformed packing must be rolled over threads or splines.

R 3 Lubricate preformed packing with petrolatum (Material No. C02-033),
R petroleum jelly (Material No. C02-008), grade 1010 oil (Material
R No. C02-021), or engine lubricating oil (Material No. C02-019 or
R C02-023) and roll it into groove of fitting.

(b)Lubrication

Use no lubricant on threads or friction surfaces unless specified by the engine manual.

(c)Nonpositioning fittings

Lubricate the packing lightly to prevent cutting by sharp threads, then install packing on fitting so that packing lies evenly in groove of fitting. Screw fitting into boss. Tighten to the specified torque value.

(d)Positioning fittings (No backup washers).

Screw the locknut completely over the first section of threads on the fitting, past the packing groove, and onto the second section of threads. Lubricate packing to prevent cutting by sharp threads, and

install it carefully over first section of threads and into the packing groove so that it lies evenly against the second section of threads. Turn locknut until it just bears against the packing. Install fitting in boss so that packing touches the countersunk surface. Turn fitting to desired position by backing out not more than one turn. Hold fitting in position and tighten locknut to the specified torque value.

(e)Positioning fittings (With backup washers).
Screw the locknut completely over the first section of threads on the fitting, and onto the second section of threads with the washer recess facing the packing groove. Grip the backup washer firmly by its outside edge, and screw the fitting into the cupped washer. Do not use any lubricant. Continue screwing the washer onto the fitting until the washer is free on the packing groove. Pick out any slivers of plastic material cut from the washer, then press the edges of the washer into the recess in the locknut until evenly seated. Make certain that threads of fitting do not interfere with seating of washer. Lubricate and install packing as directed in step (c). Hold the locknut in position with a wrench, and turn the fitting into the boss 1.5 turns. Position the fitting as desired by turning into the boss up one additional turn (total 1.5 - 2.5 turns). Hold fitting in position and tighten locknut to the specified torque value.

(f)Universal bulkhead fittings
Attach bulkhead fitting to bulkhead with locknut as shown (Ref. Fig. 223). After the connecting tube or hose nut has been properly tightened, hold fitting with wrench and tighten locknut to the specified torque value.

H. Torque all Tubes, Manifolds and Hose Assembly Coupling Nuts

(1)TORQUE all tubes, manifold & hose assemblies coupling nuts up to 0.75 in. dia. (19.05 mm) as follows :

(a)TORQUE to all values listed in Table. Refer to paragraph 6.F.(3).

(b)Break torque and loosen nut. TORQUE again per Table in paragraph 6.F.(3).
Then, break torque and loosen nut. TORQUE again per Table in paragraph 6.F.(3).

R J. Net Torque

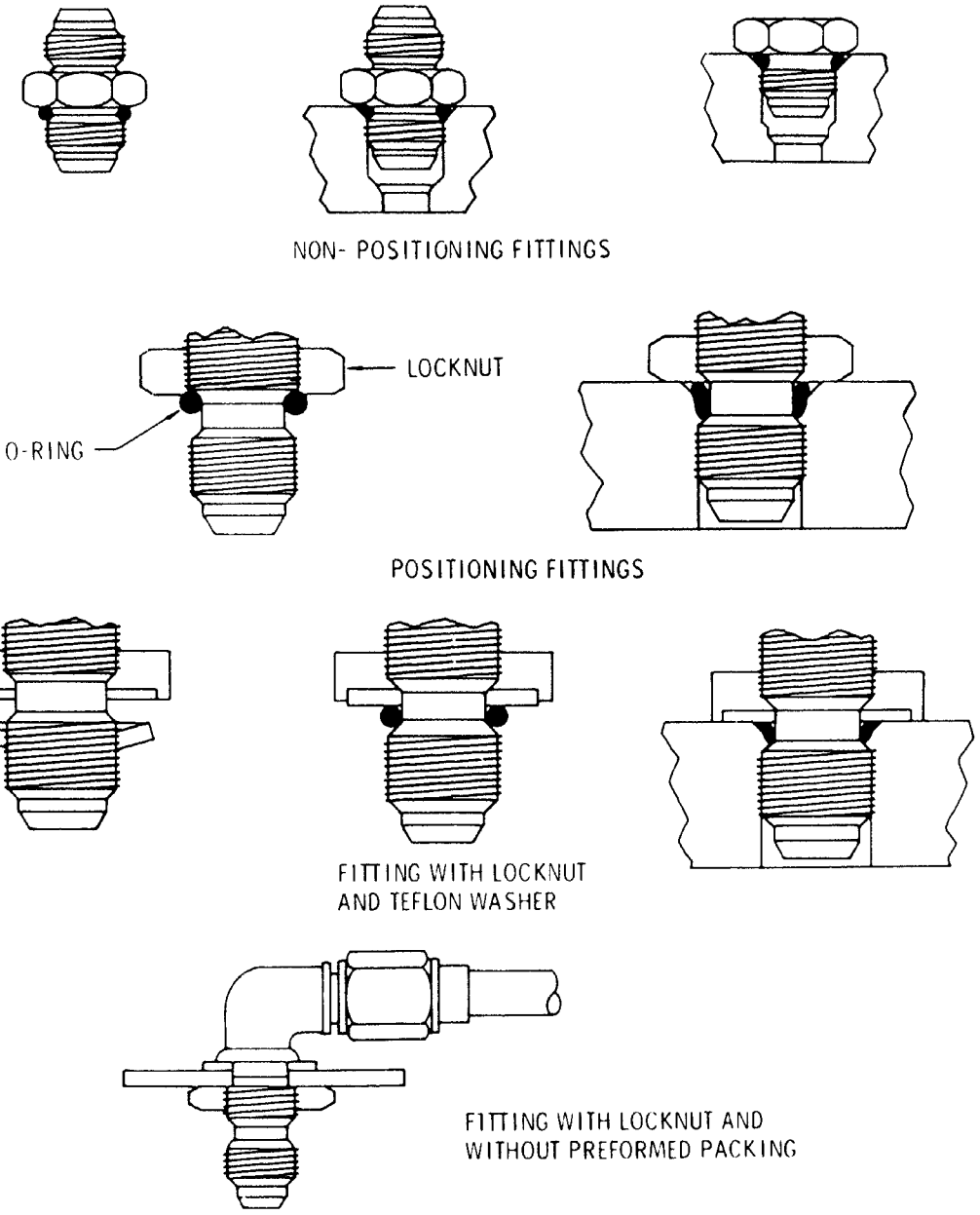
(1)In certain applications, engine manuals may specify a net torque value when the tightening force applied by the fastener is critical, and must be controlled within precise limits to obtain a specific amount of stretch to a bolt or to provide an exact amount of hold-down pressure.

(2)Net torque equals gross torque minus run-on torque. The method of determining net torque is shown in the following example.

(a)Requirement to tighten a nut on a bolt to a net torque of between 20 and 40 lbf.in. (0.246 and 0.452 m.daN).

(b)Screw the nut on the bolt, and determine the torque required to turn the nut before any tightening action takes place. Record this value as run-on torque. Assume the value to be 15 lbf.in. (0.169 m.daN).

(c)Add the run-on torque value determined in step (b) to the minimum and maximum specified torque values.



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Installation and Torque of Plugs and Tube Fittings
Figure 223

Then : 20 lbf.in. (0.23 m.daN) 40 lbf.in. (0.45 m.daN)
+15 lbf.in. (+0.17 m.daN) +15 lbf.in. (+0.17 m.daN)
35 lbf.in. (0.40 m.daN) 55 lbf.in. (0.62 m.daN)
Therefore : to obtain a net torque of 20-40 lbf.in. (0.23 - 0.45 m.daN), a gross torque of 35-55 lbf.in. (0.40 - 0.62 m.daN) must be applied to the nut.

R K. Torque Check for Re-Use of Self-Locking Nuts

NOTE : The information presented here does not apply to nuts specified in maintenance manual for one time use only.

(1)Self-locking nuts must meet the minimum breakaway torque requirements to be considered reusable.

(2)The requirements for this torque check are as follows :

(a)Refer to following list for minimum breakaway torque on self-locking nuts. This list applies to silver plated, dry-film coated, and lubricated self-locking nuts. Values given are for nuts with no axial load.

(b)To check minimum breakaway torque, install the nut onto a bolt until 2 to 5 threads are exposed beyond the nut. Measure the amount of torque required to turn the nut on or off the bolt.

CAUTION : DO NOT PINCH, SQUEEZE OR OTHERWISE DEFORM ANY SELF-LOCKING NUT TO OBTAIN OR REGAIN SELF-LOCKING TORQUE.

(c)All nuts that do not meet these minimum frictional requirements should be replaced.

Minimum breakaway torque for self-locking nuts.

	THREAD SIZE	THREADS/INCH	MINIMUM BREAKAWAY TORQUE
	0.136 (6)	32/40	1.0 lbf.in. (0.01 m.daN)
	0.164 (8)	32/36	1.5 lbf.in. (0.02 m.daN)
	0.190 (10)	32	2.0 lbf.in. (0.02 m.daN)
	1/4	28	3.5 lbf.in. (0.04 m.daN)
	5/16	24	6.5 lbf.in. (0.07 m.daN)
	3/8	24	9.5 lbf.in. (0.11 m.daN)
	7/16	20	14.0 lbf.in. (0.16 m.daN)
	1/2	20	18.0 lbf.in. (0.20 m.daN)
	9/16	18	24.0 lbf.in. (0.27 m.daN)
	5/8	18	32.0 lbf.in. (0.36 m.daN)
	3/4	16	50.0 lbf.in. (0.56 m.daN)
R	7/8	14	70.0 lbf.in. (0.79 m.daN)
R	1.0	14	92.0 lbf.in. (1.04 m.daN)
R	1 1/8	12	117.0 lbf.in. (1.32 m.daN)
R	1 1/4	12	143.0 lbf.in. (1.62 m.daN)

R L. Torque Procedure for V : Band Type Clamps

(1)Tighten the V-band nut to 50 percent of the required torque. Make certain that the coupling is seated over the flanges equally around the periphery and the seal is properly seated, if applicable.

(2)With plastic or nonmetallic mallet tap the coupling lightly around its circumference to distribute the V-band tension.

(3)While increasing the torque toward 100 percent of the specified value,

lightly tap the outer periphery as necessary to prevent unequal loading.

(4)After 100 percent of the specified torque is reached, tap around the band again and retorque once more to the specified value.

R M. Torque Procedure for Misalignment Joint Couplings

(1)Lubricate threads and inside aft flange of coupling nut with anti-seize compound (CO2-058).

(2)Assemble tube ends together making certain female fitting is seated and centered over male fitting around entire circumference. If used, make certain metal gasket seal is properly seated. Tighten the coupling nut to 50 percent of required torque.

(3)With plastic or non-metallic mallet, tap coupling nut lightly around entire circumference to distribute misalignment joint loading.

(4)While increasing the torque toward 100 percent of required value, continue to lightly tap coupling nut to prevent unequal loading.

(5)After specified torque requirement is reached, tap around coupling nut circumference again.

(6)Break torque and loosen coupling nut one-half turn.

(7)Tighten coupling nut to required value.

TUBE SIZE - OD	REQUIRED TORQUE
0.750 - 1.000 in. (19.05 - 25.4 mm)	24 - 26 lbf.ft. (3.25 - 3.53 m.daN)
1.125 - 1.500 in. (28.58 - 38.10 mm)	60 - 70 lbf.ft. (8.13 - 9.49 m.daN
1.625 - 2.000 in. (41.28 - 50.80 mm)	70 - 80 lbf.ft. (9.49 - 10.85 m.daN)
2.125 in. AND UP (53.98 mm AND UP)	80 - 90 lbf.ft. (10.85 - 12.20 m.daN)

Standard Torque Values for Misalignment Joint Couplings

R N. Install Electrical Connectors as Follows :

(1)Engage the connector and turn the knurled coupling ring while the back shell assembly is moved side to side.

(2)Use teflon jawed connector pliers and tighten the coupling ring until slippage occurs.

(3)Try to move the connector side to side to make certain the connector is fully engaged. The connector must not move.

(4)Do steps 2 and 3 again if necessary.

NOTE : It may be necessary to loosen the cable clamps that prevent the connection.

7. Cleaning Procedures

A. Cleaning External Drain Tubes

(1)General

This cleaning method is recommended for removal of gum and varnish from the bores and outside surfaces of external drain tubes.

(2)Equipment and materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Stainless Steel Tank
C. Material No.C04-002	Cleaning Compounds and Solvents (Ref. 70-00-00)
D. Material No.C04-076	Cleaning Compounds and Solvents (Ref. 70-00-00)
E. Material No.C04-077	Cleaning Compounds and Solvents (Ref. 70-00-00)
Referenced Procedure	
- 71-13-00, P. Block 301	Cowl Doors

(3)Job set-up

(a)Open, safety and tag the circuit breakers for the appropriate engine and open fan and thrust reverser cowl doors (Ref. 71-13-00, P. Block 301).

(b)Install access platform.

(c)Remove external drain tubes.

(4)Procedure

Clean external drain tubes in accordance with the following steps :

WARNING : CLEANING SOLVENTS ARE HIGHLY FLAMMABLE, VOLATILE, AND TOXIC. THEY SHOULD BE USED WITH ADEQUATE VENTILATION. AVOID PROLONGED BREATHING OF VAPORS AND REPEATED OR PROLONGED CONTACT WITH THE SKIN.

CAUTION : SOME PLASTICS AND RUBBER-BASE MATERIALS ARE ATTACKED BY HYDROCARBON SOLVENTS.

(a)Immerse tube in Materials No. C04-076 and No. C04-077 at room temperature. Let the tube soak for 1 to 2.1/2 hours.

CAUTION : MAKE CERTAIN THAT NO PART OF SWAB OR CLOTH IS LEFT IN THE TUBE. THE RESULTING FLOW RESTRICTION COULD CAUSE SERIOUS ENGINE DAMAGE.

(b)After soaking is complete, pull a clean swab or lint-free cloth through the bore of the tube to remove softened carbon residue.

(c)Rinse the tube thoroughly in Material No. C04-002.

(d)Blow dry with clean shop air.

(e)Procedure may be repeated.

(5)Close-up

(a)Install external drain tubes.

(b)Make certain that working area is clean and clear of tools and miscellaneous items of equipment.

(c)Remove access platform.

(d)Remove safety clips and tags and close circuit breakers for the appro-

priate engine. Close thrust reverser and fan cowl doors (Ref. 71-13-00, P. Block 301).

B. Manually - Assisted Detergent Cleaning

(1)General

This cleaning method uses a liquid solution of detergent in combination with mechanical agitation to remove oil, grease, soot and various foreign deposits formed on cold-section parts of the engine. The following process is recommended to prepare the surface for fluorescent-penetrant inspection.

(2)Equipment and materials

ITEM	DESIGNATION
A.	Fiber Bristle Brushes
B.	Plastic or Stainless Steel Containers
C.	Water Spray Gun
D. Material No.C04-043	Cleaning Compounds and Solvents (Ref. 70-00-00)
E. Material No.C04-044	Cleaning Compounds and Solvents (Ref. 70-00-00)
F. Material No.C04-045	Cleaning Compounds and Solvents (Ref. 70-00-00)
G. Material No.C10-010	Miscellaneous (Ref. 70-00-00)
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

(3)Job set-up

(a)Open, safety and tag the circuit breakers for the appropriate engine and open cowl doors (Ref. 71-13-00, P. Block 301).

(4)Procedure

(a)Flush part with clean water.

(b)Saturate Material No. C10-010 and fiber bristle brush with a 2-50 percent concentration of detergent cleaning solution. (Use hot water for mixing detergent in solution.)

(c)Vigorously scrub the area containing foreign material using the polishing pads and scrub brush as required.

NOTE : Either hand or mechanical operation of brushes is permitted; however, precautions should be taken to prevent any metallic portion of the brush or driving mechanism from contacting part surface.

(d)After deposits are removed, flush part with clean water as necessary.

(e)Blow dry with clean, dry air.

(5)Close-up

(a)Visually check the part for cleanliness.

(b)Remove safety clips and tags and close circuit breakers for the appropriate engine. Close cowl doors (Ref. 71-13-00, P. Block 301).

R C. Aqueous Immersion Cleaning for Light Soil/Sludge/Oil Varnish Removal from
R All Materials
R (1)General

R This cleaning process makes use of a mild organic bath (coconut oil soap), active when hot, used to dissolve light soils such as oil sludge and baked oil varnish. The bath is safe for most metallic and non-metallic materials such as, but not limited to, sump housings, heat shields, carbon bearing seals, carbon seal rings, and electrical rotors and stators.

R (2)Equipment and materials

ITEM	DESIGNATION
A.	Circuit Breaker Safety Clips
B.	Fiber Bristle Brushes
C.	Plastic or Stainless Steel Containers
D.	Stainless steel hot water cleaning tank, 210°F (99°C)
E.	Water Spray Gun
F.	Soft Bristle - commercially available
G.	Rags, lint free
H. Material No.C02-023	Anti-Seize Compounds, Lubricants, Oils (Ref. 70-00-00)
J. Material No.C04-028	Cleaning Compounds and Solvents (Ref. 70-00-00)
Referenced Procedure - 71-13-00, P. Block 301	Cowl Doors

R (3)Job set-up

(a)Open, safety and tag the circuit breakers for the appropriate engine and open cowl doors (Ref. 71-13-00, P. Block 301).

R (4)Procedure

(a)Put the part to be cleaned fully in a tank that has the coco oil solution (Material No.C04-028). Keep the solution at the specified temperature.

1 The solution should be 1 part Coconut oil soap to 7 parts water at a temperature of 180-210°F (82-99°C)

(b)Soak the part in the solution for 2 to 12 hours or until the oil soil becomes loose and can be removed with a stiff, non-metallic brush or rag.

1 Make sure that all loose contamination is removed from any blind internal passages in the hardware.

(c)Drain the part over the cleaning tank to let the excess solution to drain back into the tank.

WARNING : PARTS WILL BE HOT. USE CORRECT PERSONAL PROTECTIVE EQUIPMENT SUCH AS FACE SHIELD, GLOVES, PROTECTIVE CLOTHING AND PROTECTIVE SHOES. IF YOU DO NOT DO THIS, INJURY CAN OCCUR.

(d)Rinse/flush the part with water and the drain. Do the process again if necessary.

(e)Dry using clean, dry air or oven bake at 250°F (121°C) for 2 to 4 hours to remove moisture.

(f)Apply a thin coat of engine lubricating oil (Material No.C02-023) to any bare ferrous metal surfaces to stop rust as necessary.

R (g)Visually check for the removal of all traces of carbon coking residues

R from the part.
R 1 If you see particles, do the cleaning process again and inspect
R the part again.
R (5)Close-up
R (a)Remove safety clips and tags and close circuit breakers for the appli-
R cable engine. Close cowl doors (Ref. 71-13-00, P. Block 301).

8. Standard Fluorescent-Penetrant-Inspection (Local Application)

A. General.
(1)This fluorescent-penetrant-inspection procedure (FPI) gives instructions to examine welded or other local repair areas.
(2)If a part has been inspected with visible nonfluorescent-color-dye-penetrant, contamination to the dye will prevent a satisfactory FPI.
(3)Titanium alloy parts must be fully cleaned with non-halogen compounds after they touch any halogen compound to prevent stress-corrosion, cracking, and possible failure of parts. De-ionized water must be used to examine parts made of titanium or titanium alloy.

B. Examine the part.
(1)Standard tools and equipment
(a)Hood - Black Cloth, to prevent too much white light.
NOTE : A defective part can be used to do a test of the white light shielding.
(b)Air Source - Regulated Compressed, Dry Filtered
(c)Light - Black (Ultraviolet)
(d)Light - White
(e)Time Piece
(f)Lens - Magnifying, 3x and 10x power
(2)Consumable materials
(a)Ardox FPI system
1 G02035 Penetrant - Ardox 985P13
2 G02031 Developer - Ardox 9D6
3 G01255 Developer - D499C (optional to G02031)
(b)Magnaflux FPI system
1 G01114 Penetrant - Zyglo, ZL22A
2 G02036 Penetrant - Zyglo, ZL22C
3 G02033 Developer - Zyglo ZP9C
4 G01255 Developer - D499C (optional to G02033)
(c)Turco FPI system
1 G01153 Penetrant - Fluro Check P40B
2 G01206 Penetrant - Fluro Check P41
3 G01231 Developer - Fluro Check NAD-NF
4 G01255 Developer - D499C (optional to G01231)
(d)G00834 Cloth - Cotton, Lint-free
(e)B00448 Solvent - Trichloroethane 1, 1, 1, Technical Inhibited, O-T-620A, with Halogen
(f)B00185 Alcohol - Isoprophyl, TT-I-735, Halogen Free
(g)B00148 Solvent - Methyl Ethyl Ketone (MEK), TT-M-261, Halogen Free
(h)B00062 Solvent - Acetone, O-T-634, Halogen Free
R (j)G00623 Swabs - Cotton
R (k)G00000 Brush - Fine-Hair Art (optional to cotton swabs)
(3)Access
(a)Location zone
(4)Procedure
CAUTION : DO NOT USE PROCEDURES SUCH AS HEAVY GRINDING, SCRAPING, CHIPPING, AND PEENING THAT CAN SMEAR METALS ONTO DISCONTINUI-

TIES.

(a)Clean the part(s) to be examined.

(b)Plug the tubes and holes with a cap in the area to be examined to keep materials out.

(c)Apply the penetrant.

WARNING : PENETRANT IS FLAMMABLE WHEN USED AS A SPRAY. TAKE PRECAUTIONS AGAINST FIRE.

1 Apply the penetrant by spraying or brushing.

NOTE : Penetrants used for inspection must be at a temperature between 60°F-100°F (16°C-38°C). The penetrant and developer used must be listed for the specific FPI system you use.

2 Permit a minimum of 30 minutes for penetration.

(d)Remove unwanted penetrant.

1 Rub with a clean dry cloth to remove unwanted penetrant.

WARNING : DO NOT GET SOLVENT OR ALCOHOL IN YOUR MOUTH OR EYES, OR YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT OR ALCOHOL. PUT ON GOGGLES AND GLOVES FOR SPLASH PROTECTION WHEN YOU USE SOLVENT OR ALCOHOL. KEEP SOLVENT OR ALCOHOL AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENT AND ALCOHOL ARE POISONOUS AND FLAMMABLE MATERIALS WHICH CAN CAUSE INJURY OR DAMAGE.

CAUTION : USE A HALOGEN-FREE SOLVENT OR ALCOHOL ON PARTS MADE OF TITANIUM OR TITANIUM ALLOY.

2 Rub with a clean cloth that is moist with solvent or alcohol to remove background fluorescence.

3 Examine the part with ultraviolet light to make sure unwanted penetrant is not there.

NOTE : Do not wear light-sensitive glasses when you use ultraviolet light because they will get darker.

CAUTION : APPLY SOLVENT OR ALCOHOL IN SMALL QUANTITIES. INDICATIONS OF DEFECTS CAN BE DECREASED BY UNWANTED SOLVENT OR ALCOHOL SPRAYING.

4 If unwanted background fluorescence continues, apply a light solvent or alcohol spray while you examine with ultraviolet light. Apply the spray in a direction that is not at 90 degrees to the surface. Only apply the spray to the area one time.

(e)Apply the developer.

WARNING : DO NOT BREATHE DEVELOPER VAPORS. THE DEVELOPER IS POISONOUS.

CAUTION : USE A DEVELOPER THAT IS FROM THOSE LISTED FOR THE SAME FPI SYSTEM AS THE PENETRANT.

1 Apply the developer as a spray only to a dry part at ambient temperature. Apply a light, thin layer with the spray nozzle about 8-10 in. (200-250 mm) from the part surface. Usually, two layers are sufficient. Layers must be of equal thickness. A metallic background must be seen through the developer.

NOTE : Follow the manufacturer's directions when you use an aerosol container.

2 Permit a minimum of 10 minutes for the developer to absorb the penetrant.

(f)Examine the parts.

1 Point the ultraviolet light at the part while below a black cloth hood.

NOTE : Do not wear light-sensitive glasses when you use ultraviolet light because they will get darker.

2 Examine any indications that you are not sure of as follows :
- Use a cotton swab or soft hair brush to rub the area one time with solvent or alcohol.
- Apply developer to the area after solvent or alcohol is dry.
- Examine with ultraviolet light. Indications that show in less than 2 minutes are satisfactory indications.
- If indications do not show, examine the part with white light and a magnifying lens.
- Use an approved marking method to identify the location of defects.
- Reject any parts that have surface defects that are more than the limits. If limits are not specified, reject any surface defects as follows : shrinkage cracks or porosity, cold shuts, fatigue cracks, forming cracks, grinding and heat treat cracks, seams, laps, and bursts.
- Examine welds and accept or reject them by applicable weld specifications.
- Parts or areas of parts reworked as a result of penetrant indications must be examined again in accordance with this specification before you can accept them.

(g)Clean the parts after you examine them.

CAUTION : **ALL PENETRANT AND DEVELOPER MATERIAL MUST BE REMOVED FROM THE PART AS SOON AS POSSIBLE. MATERIAL THAT IS NOT REMOVED CAN CAUSE DANGEROUS CORROSION OF THE PARTS AT HIGHER TEMPERATURES AND PROBLEMS DURING WELDING.**
WHEN YOU CLEAN PARTS MADE OF TITANIUM OR TITANIUM ALLOYS WITH SOLVENT, USE ONLY SOLVENTS THAT DO NOT HAVE HALOGENS.
WHEN YOU CLEAN PARTS MADE OF TITANIUM OR TITANIUM ALLOYS WITH WATER, USE ONLY DEIONIZED WATER.

1 Remove developer and penetrant by a water-spray washing or rub the part with a brush and water.

WARNING : **DO NOT GET SOLVENT OR ALCOHOL IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM SOLVENT OR ALCOHOL. PUT ON GOGGLES AND GLOVES FOR SPLASH PROTECTION WHEN YOU USE SOLVENT OR ALCOHOL. KEEP SOLVENT OR ALCOHOL AWAY FROM SPARKS, FLAME, AND HEAT. SOLVENT AND ALCOHOL ARE POISONOUS AND FLAMMABLE MATERIALS WHICH CAN CAUSE INJURY OR DAMAGE.**

2 Make sure all internal passages and recesses are fully clean and dry. Blow out passages and recesses with dry air.

(h)Examine the part with ultraviolet light to make sure all penetrants and developer materials have been removed.

R (j)Make sure that all processing compounds are fully removed from titanium and titanium alloy parts.

9. Chemical Touch-up Alodine

A. General

(1)This procedure gives the instructions for the chemical touch-up or refinish of aluminum surfaces from which the original anodized protective finish has been removed.

(2)The solution to restore the protective film can be brushed, sprayed, or sponged on the prepared area.

B. Equipment and Materials

ITEM	DESIGNATION
(1)Material No.C03-081	Finishes and Protective Coatings (Ref. 70-00-00)
(2)Material No.C03-082	Finishes and Protective Coatings (Ref. 70-00-00)
(3)Material No.C03-084	Finishes and Protective Coatings (Ref. 70-00-00)
(4)Material No.C04-002	Cleaning Compounds and Solvents (Ref. 70-00-00)
(5)Material No.C04-003	Cleaning Compounds and Solvents (Ref. 70-00-00)
(6)Material No.C04-035	Cleaning Compounds and Solvents (Ref. 70-00-00)

C. Procedure

WARNING : THE SOLUTIONS USED IN THIS PROCESS ARE HIGHLY CORROSIVE. USE RESPIRATORS, GOGGLES OR FACE SHIELD, RUBBER OR NEOPRENE GLOVES, BOOTS AND APRONS WHEN HANDLING OR APPLYING THE SOLUTION. WASH OFF IMMEDIATELY IF SOLUTION CONTACTS THE SKIN.
IF SOLUTION CONTACTS THE EYES, FLUSH THEM WITH CLEAR WATER, IRRIGATE WITH BORIC ACID SOLUTION, AND SEEK IMMEDIATE MEDICAL AID.

WARNING : CHLORINATED HYDROCARBON SOLVENTS ARE TOXIC, AND SHOULD BE USED IN A WELL-VENTILATED AREA. AVOID PROLONGED BREATHING OF VAPORS. REPEATED OR PROLONGED CONTACT WITH THE SKIN WILL DISSOLVE FAT AND SKIN OILS, AND CAN CAUSE SEVERE DERMATITIS.

CAUTION : DO NOT LET SURFACE COATING SOLUTION CONTACT ORGANIC SOLVENTS. IF CAN IGNITE THEM.

(1)Clean surface with liquid solvent degreaser such as follows :
- Material No.C04-002
- Material No.C04-003
- Material No.C04-035
- other approved non-hazardous solvent.

(a)Use a clean brush or lint-free cloth.

(2)Use 180 grit, aluminum oxide abrasive paper and sand the area lightly.

(3)Alternative procedure available. If you use Material No.C03-081 or Material No.C03-082, apply the refinishing solution as follows :

(a)Apply the refinishing solution with an acid-resistant nylon-bristle brush cellulose sponge.
1 Keep part wet with solution until coating is fully formed (usually from one to ten minutes).
(4)Alternative procedure. If you use Material No.C03-084, apply the refinishing solution as follows :
(a)Mix parts A and B together in equal volume, stirring thoroughly.
(b)Apply refinishing solution Material No.C03-084 with an acid-resistant nylon-bristle brush cellulose sponge.
1 Keep part wet with solution until coating is fully formed (usually from one to ten minutes).
(5)Check the color and texture of the coating.
(a)The coating is usually a golden iridescent color, that can vary with different alloys and processing conditions.
1 If the coating is powdery, the treatment time was longer than necessary.
- Powdery coating should be removed and the coating redone.
CAUTION : BE CAREFUL TO PREVENT SPLASHING OR SPRAYING OF REFINISHING SOLUTION ON METALS OTHER THAN ALUMINUM. THE SOLUTION IS HIGHLY CORROSIVE.
(6)Use one of the following methods to rinse off the refinishing solution thoroughly :
(a)Flush with clear water.
(b)Immerse in overflowing water (120° to 140°F or 49° to 60°C).
(c)Remove with a wet sponge.
(d)Do not rinse with the jet from a hose or with a pressure spray.
1 Do not let liquids stay in cavities or depressions in the part.
2 A blast of clean shop air can be used to blow liquids from the part.
CAUTION : WHEN YOU WIPE THE PART, BE CAREFUL TO AVOID SCRATCHING OR RUBBING OFF THE COATING, WHICH IS DELICATE WHEN FRESHLY FORMED.
(7)Dry the part with shop air or with a clean, soft cloth.
CAUTION : DO NOT LET SWABS, CLOTHS, PAPER, ETC. THAT YOU USE TO APPLY OR REMOVE THE SURFACE COATING SOLUTION TO DRY OUT. THESE MATERIALS ARE COMBUSTIBLE WHEN DRY AND CAN BE A FIRE HAZARD. IMMEDIATELY AFTER USE, SOAK THE ITEMS THOROUGHLY IN WATER BEFORE YOU DISCARD THEM.
(8)If the part is to be painted, let the surface coating set for at least 30 minutes to cure before you apply the paint.
(9)Store touch-up solution in plastic container.
(a)It will deteriorate in plain glass or steel containers.

10. Etch Procedures

A. General

(1) You must use the chemical etch procedure on the stationary weldments before you do a fluorescent-penetrant inspection. Smeared surface material parent metal caused by operations such as benching of welds, can cover cracks and flaws in metal parts that prevent identification during the inspection process. Etchants are selected to remove this unwanted material and find the flaws. The etchants are classified as follows by their application to specified metals but you can use other applications when authorized :

(2) Classifications

NOTE : You must use the swab etchants that follow only on the metals listed, unless otherwise specified.

CLASS	METALS
Class A	Magnesium alloys
Class B	Titanium alloys
Class C	Stainless Steel Etchants (Schantz Reagent) : - 300- and 400- series stainless steels, - precepitation hardening steels - A-286 - maginal steels - Rene'77, 80, 95, 100 and 125 - Udiment 500 - Sel and Sel 15 - TD-Ni-Cr - Waspalloy - M152 - 17-4 PH - Hastelloy B, C and W
Class D	Superalloy Etchant - Rene'41 - Astroloy - Hastelloy X - HS 188 - Inconel 718 - all other Inconel metals
Class E	Carbon steel, bearing and gear alloys
Class F	Aluminum
Class G	Inconel 718 (Alternative)

B. Swab Etch Procedures for Fluorescent-Penetrant Inspection

(1) General

(a) These instructions give the materials and procedures to swab etch the surfaces before you do a fluorescent-penetrant inspection. Unless otherwise identified, use these etchants as specified for individual parts.

(2) Consumable Materials

(a) Keep all stock etchant solutions in plastic containers, (polypropylene,

acid-resistant quality) as recommended.
1 Class B etchant attacks glass.
2 You must keep Class B and Class F etchants in plastic bottles.
3 Class A, C, D, E and G etchants can be kept in glass bottles, if it is necessary.
4 Store away from heat and do not permit the etchant solutions to freeze.

(b)The shelf life of each class of etchant follows :
1 Class A : 1 year
2 Class B : 1 month in a plastic bottle that has a stopper. Permit 60 minutes for the gas to be released after you make the solution and before you replace the bottle stopper.
3 Class C : 6 months
4 Class D : 60 minutes (after you mix the solution), hydrochloric acid has a shelf life of 1 year.
5 Class E : 6 months
6 Class F : 1 year
7 Class G : 1 year

(c)You must label each container of the stock solution with the Class identification of the contents, and the expiration date of the shelf-life period.

(d)A supply of distilled water must be available to mix the etchants, and to flush them from the etched area of the work.
NOTE : You can use clean tap water to flush the Class G etchant.

(3)Procedure
WARNING : YOU MUST MONITOR THE SHORT SHELF LIFE OF THE CLASS D ETCHANT. IT CAN BECOME HAZARDOUS TO PERSONS. AFTER ONE HOUR, THE MIXTURE CAN BECOME NOT SERVICEABLE AND GIVE OFF NITROUS OXIDE. IF TIGHTLY CAPPED, THE CONTAINER CAN BREAK OPEN. THE MIXTURE CAN ALSO BECOME HOT. IF YOU DO NOT OBEY THIS PROCEDURE, YOU CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO EQUIPMENT.
DO NOT GET THE ETCHANTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE ETCHANTS. THE ACTIVE INGREDIENTS OF THE ETCHANTS ARE TOXIC AND CORROSIVE. USE IN A WELL VENTILATED AREA, WEAR PROTECTION CLOTHES, GLOVES, AND A FACE SHIELD. IF THE SOLUTION GETS IN YOUR EYES, FLUSH FULLY WITH COOL WATER BENEATH THE EYE LIDS, AND GET MEDICAL HELP IMMEDIATELY. IF YOU DO NOT OBEY THIS PROCEDURE YOU CAN CAUSE INJURIES TO YOURSELF AND OTHER PERSONS.

(a)Do these steps to etch the metal surfaces unless otherwise specified :
1 You must clean all of the surfaces to be etched.
- Make sure you remove these materials :
. the oil
. the grease
. the scale
. the other unwanted material.

2 Put a small quantity of the stock solution into a clean plastic beaker or dish.
- This quantity will be the solution, and is not to be put back into the stock bottle.

3 Soak a cotton swab with the solution, and rub the surface to be

etched for 60-90 seconds for all classes A thru F.

4 Etch time for Class G is 3-4 minutes.
- Keep the etch solution in the boundaries to be etched.
- Put tape around the area to be etched to contain the solution in the applicable area.

NOTE : Use more solution to keep the metal wet at all times. Dip the swab into the solution regularly. Rub the swab continuously on the metal that you etch.

5 After you etch, remove the etch solution and dry the metal surface with a clean paper towel or cloth.

6 Lightly clean the etched area a minimum of three times with a cloth or paper towel that is moist with clean water.
- Dry the etched area with a cloth or paper towel.

WARNING : DO NOT PUT THE SOLUTION BACK INTO THE STOCK CONTAINER. ALTHOUGH THE SMALL QUANTITIES ARE NOT AN ENVIRONMENTAL HAZARD, FLUSH THE DISCARDED SOLUTION SEVERAL TIMES WITH WATER. IF YOU DO NOT OBEY THIS PROCEDURE, YOU CAN CAUSE DAMAGE TO THE MATERIAL.

7 Discard the used solution.

8 Flush and dry the plastic container so you can use the plastic container again.

C. Consumable Materials for the Etch Solutions

(1)General

(a)The commercially available reagents that follow are necessary to make the etchants that you use to prepare metals before a fluorescent-penetrant inspection.

COMPOUND (See NOTE)	STRENGTH
Acetic Acid	99.7%
Ferric Chloride (FeC13.6H2O)	
Hydrochloric Acid (Muratic) 20°Be	36.5-38%
Hydrofluoric Acid	48%
Nitric Acid	69-71%
Oxalic Acid	
Sodium Hydroxide	Pellets
Sulfuric Acid	95-98%
Tartaric Acid	
Water	Distilled or de-ionized

NOTE :
Commercial grade or better is satisfactory, if the concentration/strength is the same.

(2)Instructions for the Etch Procedure

WARNING : DO NOT GET THE ETCHANTS IN YOUR MOUTH OR EYES, OR ON YOUR SKIN. DO NOT BREATHE THE FUMES FROM THE ETCHANTS. THE ACTIVE INGREDIENTS OF THE ETCHANTS ARE TOXIC AND CORROSIVE. USE IN A WELL VENTILATED AREA, WEAR PROTECTION CLOTHES, GLOVES, AND A FACE SHIELD. IF THE SOLUTION GETS IN YOUR EYES, FLUSH FULLY WITH COOL WATER BENEATH THE EYE LIDS, AND GET MEDICAL HELP IMMEDIATELY. IF YOU DO NOT OBEY THIS PROCEDURE YOU CAN CAUSE INJURIES TO YOURSELF AND OTHER PERSONS.

CAUTION : NEVER ADD WATER TO ACID. ALWAYS ADD ACIDS TO THE WATER WHILE YOUR STIR THE SOLUTION. IF YOU DO NOT OBEY THIS PROCEDURE, YOU CAN CAUSE INJURIES TO PERSONS AND DAMAGE TO THE EQUIPMENT.

(a)Add the chemicals in sequence and proportions given in the formulas that follow.

1 Fully mix each before you add the next chemical.

(b)You use ferric chloride to make the Class C and Class G etchants. It is usually supplied in lump form.

1 You can use it in the molten form to help the mix.

2 Is melting point is 98.6°F or 37°C.

3 It can also be crushed and added in the granular or powdered form with a constant stir until it has dissolved.

4 Ferric chloride is extremely hygroscopic (changes to a liquid very fast).

- You must keep the supply that you do not use sealed very tight.

NOTE : Ferric chloride dissolves faster when you use hot water (150° to 190°F) (65.6° to 87.8°C).

(c)Glacial (99.7%) acetic acid freezes at slightly below room temperature 62°F (16.7°C).

1 To help pour and mix the acid, put the container in warm water for a few minutes.

(d)Loosen the stopper or caps of the bottles carefully to prevent a spray from the solution as you open the bottles.

(3)The Formulas and Swab Etchants

(a)With average use these formulas are for quantities that are estimated not to last beyond the shelf-life period of the etchant.

1 You can make larger or smaller quantities as long as the proportions are equal to those specified.

Class A	Magnesium Alloys	
	Oxalic acid.....	10 grams
	or	
	Tartaric acid.....	
	Distilled water.....	90 ml
Class B	Titanium Alloys	
	Distilled water.....	62 ml
	Nitric acid.....	35 ml
	Hydrofluoric.....	3

Class C	Stainless Steels (Schantz Reagents)	
	Distilled water.....	750 ml
	Sulfuric acid.....	150 ml
	Hydrochloric acid.....	1800 ml
	Nitric acid.....	500 ml
	Acetic acid.....	750 ml
	Ferric chloride.....	454 grams (1 lb)

NOTE : Refer to the shelf life limits of each class above and add ferric chloride immediately.

Class D	Superalloys	
	Schantz Reagent (Class C).....	10 ml
	Hydrochloric acid.....	10 ml

NOTE : Refer to the shelf life limits of each class above and add ferric chloride immediately.

Class E	Carbon steels, bearing and gear alloys	
	Distilled water.....	95 ml
	Nitric acid.....	5 ml
Class F	Aluminum alloys	
	Distilled water.....	60 ml
	Sodium hydroxide.....	20 grams
	Distilled water to make.....	100 ml
Class G	Inconel 718	
	*Ferric chloride.....	38 grams
	Tap water.....	23 ml
	Hydrochloric acid.....	28 ml
	Tap water to make.....	76 ml
	*Refer to the shelf limits above.	

NOTE : Let the solution become cool to room temperature before you add the make-up water.

NOTE : Use distilled or de-ionized water unless the instructions tell you otherwise.

11. Temperature Indicating - Task Supporting Data

A. General

This procedure gives the standard test conditions required to do the test of the exhaust gas temperature (EGT) indicating system.

B. Test Conditions

(1) Troubleshooting, circuit resistances and circuit to ground measurements must be done under the conditions that follow:

(a) Ambient temperature must be 0 deg.C to 40 deg.C (32 deg.F to 104 deg.F).

(b) The relative humidity is to be less than 80 %. If the relative humidity is greater than 80 % the 10 Mohm resistances to ground limit in the procedure can be reduced to 1 Mohm.

(c) Following an engine shutdown with a minimum of one hour cool down and with no water exposure to the exhaust gas temperature (EGT) T49.5 harnesses or probes.

(2) Resistance measurements should be made using a low voltage, digital type multimeter to minimize the instability of the indications due to the heating effects of the type K T/C junctions.

(3) Multimeter test probes and jumper wire tip diameters must be fitted with gold plated, 20 gage (Ref. 0.039 in. diameter) or 16 gage (Ref. 0.062 in. diameter) electrical pins or sockets, where applicable. This will prevent contamination and damage to the connector contacts when you do the circuit resistance measurements.

(4) Inspect the electrical contacts for wear and possible root cause due to intermittent fault during circuit resistance checks. While you do the circuit resistance checks, and with the use of gold plated electrical pins, there must be a slight drag on the pin when you remove it from the contact. If there is no drag and the pin falls freely out of the contact, then the socket contact is damaged and is the probable cause for the faulted condition. If this condition is found, the unit with the defective electrical contact must be removed and replaced.

(5) Type K thermocouple resistance values are obtained by measuring and recording the circuit resistance test value when it becomes stable. Reverse the test lead polarity and measure and record the circuit resistance test value again when it becomes stable. Average these two readings, and then subtract the test lead resistance from the averaged reading to obtain the circuit resistance value.

(6) When you do resistance measurements, connector contact areas including interfacial seals must be free of dirt, contamination and moisture. It is recommended that you clean with isopropyl alcohol and a soft bristle brush, then blow dry with shop air and/or air dry for contamination removal. After circuit resistance testing and prior to reconnecting the connectors, it is recommended that the final contact cleaning be done with a use of a contact cleaner/enhancer. Use a recommended cleaner/enhancer to apply a single short burst of spray into each electrical socket or onto each electrical pin. Wait several seconds and reassemble the connector hand tight. Then torque the connector (approximately 1/16 to 1/8 turn) with soft-jawed pliers until the pliers slip on the connector.

12. Consumable Products Section

A. General

This section lists the consumable products used for maintenance and repair of CF6-80 Commercial Turbofan Engines. The section is organized as follows :

(1) Consumable products

A tabulation of each product is provided and categorized by a reference number or code. Also provided is a description of each product, the manufacturer and packaging, shelf life and remarks. The consumable product categories are as follows :

Code	Category
C01	Adhesives, Plastics, Sealants
C02	Anti-Seize Compounds, Lubricants, Oils
C03	Finishes and Protective Coatings
C04	Cleaning Compounds and Solvents
C05	Inspection and Marking Compounds
C06	Weld, Braze
C07	Lacquers
C10	Miscellaneous

(2) Consumable location references.

Location reference for Consumable Products used in maintenance and repair are listed in 70-00-00.

B. Procurement Information.

For procurement convenience, the consumable products listed herein may be obtained from :

General Electric Supply Co.
401 East Hunting Park Avenue
Philadelphia, PA 19124

CONSUMABLE PRODUCTS

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C01-006	Adhesive, Silicone Rubber		
	RTV-103 (Black)	GE Company, Silicone Products Div. 260 Hudson River Road Waterford, NY 12188 USA FSCM-01139	
	732 Black Multi-Purpose Sealant	Dow Corning Corp P.O. Box 997 Midland, MI 48686 USA	Call for local distributors.

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C01-007	Adhesive, Silicone Rubber		
	RTV-106 (Red)	GE Company, Silicone Products Div. 260 Hudson River Road Waterford, NY 12188 USA FSCM-01139	
	736 Red Heat Resistant Sealant	Dow Corning Corp P.O. Box 997 Midland, MI 48686 USA	Call for local distributors.
R C01-008	RTV Potting Compound, Two Part (GE Spec A15F12A2)		
R	RTV 560 (Red)	Momentive Performance Materials. 22 Corporate Woods Blvd. Albany, NY 12211 USA	
C01-011	Adhesive, Epoxy Resin		Replaces (C01-019)
	EA 934NA (Part A and B) (GE Spec A50TF94 Class B)	Dexter Corp. Adhesive and Coating Systems 2850 Willow Pass Rd P.O. Box 312 Bay Point, CA 94565 USA CAGE-33564	Pkgd in 1 pt (0.47 liter), 1 qt (0.95 liter), 1 gal (3.8 liter) and 5 gal 18.8 liter) containers. Transportation not restricted. The shelf life for parts A and B is one year at 32°F (0°C) Also available in Semkits.

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Alternate (C01-155) (C01-156)	NOTE : (C01-155) and (C01-156) can be used for as a one way alternate for (C01-011). (C01-011) may not be used as an alternate for (C01-155) or (C01-156).	
C01-014	Sealant, Primer, Adhesive Silicone Alternate, C01-159		
	Dow Corning 1200	Dow Corning Corp. P.O. Box 997 Midland, MI 48686 USA Ph: 800-248-2481 FSCM-71984	Pkgd in pt and gal containers. Flash pt is 50°F (10°C). Flammable matl. shelf life is six mo. For best results store below 90°F (32°C). Containers should be kept tightly sealed when not in use.
R C01-015	Insulation, Ablative Silicone (GE Spec A50TF122)		
R	MA-25 Ablative Coating Parts A, B and C	Lockheed Martin Space Systems Company Michoud Operations P.O. Box 29304 (Attn. Dept. 3600) New Orleans, LA 70189 USA	Type III (Sheet Stock)
C01-017	Resin, Epoxy		
	EPON 828	Shell Chemical Co. One Shell Plaza	If this material is to be used in the

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		Houston, TX 77002 USA FSCM 03508	formulation of an abradable compound, (C01-060) may be used as an alternate.
		Miller Stephenson Chemical Co. George Washington Hwy. Danbury, CT 06810 USA FSCM-18598	
		E.V. Roberts and Assoc P.O. Box 868 8500 Stellar Dr. Culver City, CA 90232 USA	
C01-018	Replaced by (C10-093)		
C01-024	Reducer, Catalyst Diethylenetriamine (High Purity Grade)	Union Carbide Corp. 10235 West Little York Road Suite 300 Houston, TX 77040 USA FSCM-61637	
C01-025	Foam, Convolute Urethane Urethanap No. 3500 (2 in. thick)		Obsolete
C01-030	Sealer, Phenolic Metco Seal A.P. (GE Spec A8B35)	Sulzer Metco Inc. 1101 Prospect Ave Westbury, NY 11590 USA	Pkg size is 1 qt (0.9 l) containers. Highly inflammable. Keep away from heat, flame and sparks Flash pt is 65°F (18°C) T.C.C. Unopened containers will normally have a shelf life greater than 1 yr.

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			Std. normal room temp storage conditions.
C01-031	Metco Seal A.P.T. Thinner	Sulzer Metco Inc. 1101 Prospect Ave Westbury, NY 11590 USA	Pkg size is 1 qt (0.9 l) containers. Flash pt is 23°F (-5°C) T.C.C. Unopened containers will normally have a shelf life greater than 1 yr. Std normal room temp storage conditions.
C01-049	Compound, Silicone Rubber RTV-577	General Electric Co. Silicone Products Div. Waterford, NY 12188 USA FSCM-01139	
C01-055	Sealant Thread, Locktite 277	Locktite Corp. 1001 Trout Brook Crossing, Rocky Hill CT 06067 USA FSCM - 05972	
C01-056	Adhesive silicone Rubber RTV 108	GE Co. Silicone products Div. 260 Hudson River Road Waterford, NY 12188 USA FSCM-01139	
C01-057	Adhesive, Liquid (GE Spec A15B70A3)		
	Permabond 910	Permabond International Corporation 480 So. Dean St.	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		Englewood, NJ 07631 USA CAGE-61078	
	Pro Grip 5500	Fel-Pro Incorporated 7450 N. McCormick Blvd. Skokie, IL 60076 USA	
	Loctite Superbonder 496 (IS12)	Loctite Corporation 1001 Trout Brook Crossing Rocky Hill, CT 06067 USA Ph: (800) 562-8483 Fx: (800) 243-4874 FSCM-05972	
C01-060	Compound Abradable Epoxy (GE Spec P6TF1 Class A)		Consist of (C01-017) (C01-024), and (C10-093). Pkg size is 6 oz SEMKIT SEMCO cartridge 7.0 in. (177.8 mm) long x 1.5 in. (38.1 mm) dia, shipped in corrugated carton 36/ carton 10 lb. No trans restrictions. Wt of each component in 1 SEM Co. Tube Kit. Shell EPON 828 50 g. Nonflammable. Diethylenetri- amine, 5 g. Flash pt Cleveland Open Cup 215°F (101.6°C) Shelf life is six months at room temp.
	RSP-3 Kit	John W. Blair P.O. Box 192 140 N. Otterbein Ave. Westerville, OH 43081 USA	
	Resin Pack # 039- 080055-685	Syon Corporation 280 Eliot Street Ashland, MA 01721 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C01-062	Sealing Compound, Temperature Resistant PR1422 (MIL-S-8802)	Courtaulds Aerospace 5430 San Fernando Road Glendale CA 91209 USA	
C01-073	Compound, Sealing, Temperature Resistant		
	PR 1750	Courtaulds Aerospace 5430 San Fernando Road Glendale, CA 91209 USA PH 818-240-2060 FAX 818-549-7862	
C01-077	Compound, Sealing Hi Temp. Epoxylite, No.6203	Epoxylite Corp. 9400 Toledo Way P.O. Box 19671 Irvine, CA 92713 USA FSCM-11147	
C01-080	Replaced by (C01-157)		
C01-084	Adhesive, Film Loctite 592 (GE Spec A15B41H7)	Loctite Corp. 1001 Trout Brook Crossing Rocky Hill, CT 06067 USA FSCM-05972	Ask for customer service
C01-087	Deleted		
C01-092	Silicone Primer SS 4155	GE Company Silicone Products Div. 260 Hudson River Rd. Waterford, NY 12188 USA FSCM-01139 General Electric France BP67 91002 EVRY CEDEX FRANCE	
C01-106	Adhesive Epoxy Resin EA 956	Dexter Corp. Adhesive and Coating	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		Systems 2850 Willow Pass Rd. P.O. Box 312 Bay Point, CA 94565 USA CAGE-33564	
	Alternate, (C01-147)		
C01-115	Adhesive, Sealant PR1440-G-B2 MIL-S-81733 PS 870-B-2	Courtaulds Aerospace 5430 San Fernando Road Glendale CA 91209 USA	
C01-116	Replaced by (C01-011) or (C01-155)		
C01-117	Adhesive Epoxy Resin, Epibond 8543 (A & B)	Ciba Specialty Chemicals 5121 San Fernando Road West Los Angeles, CA 90039 USA	
C01-126	Fabric, Netting, Dacron Polyester D117	Mohawk Fabric Co. Inc.	
C01-129	Adhesive, Struc- tural Room Temperature Fast Cure		
	Hysol EA960F	Dexter Corp. Adhesive and Coating Systems 2850 Willow Pass Rd. P.O. Box 312 Bay Point, CA 94565 USA CAGE-33564	
C01-145	Jointing Compound		
	Hylomar PL32, Medium		Deleted
	SQ32L	Marston Lubricants, LTD 7-11 Naylor St. Liverpool, England	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C01-147	Adhesive, liquid structural		10 months at 77°F
	EA 9396 Parts A and B	Dexter/Hysol Aerospace Materials Division 2850 Willow Pass Rd P. O. Box 312 Pittsburg, CA 94565 USA Ph: 510-458-8000 Fax: 510-458-8030 CAGE-33564	Standard "B" Catalyst Cured at room temperature
C01-155	Adhesive, Structural Paste		
	EA9394 Parts A and B	Dexter Corp. Adhesive and Coating Systems 2850 Willow Pass Rd. P.O. Box 312 Bay Point, CA 94565 USA CAGE-33564	Standard "B" Catalyst Cured at room temperature
C01-156	Adhesive, Structural Paste		
	EA9394 Parts A and C2	Dexter Corp. Adhesive and Coating Systems 2850 Willow Pass Rd. P.O. Box 312 Bay Point, CA 94565 USA CAGE-33564	"C2" Catalyst
C01-157	Adhesive, Liquid Structural		
	EA9396 Parts A and C2	Dexter Corp. Adhesive and Coating Systems 2850 Willow Pass Rd. P.O. Box 312	"C2" Catalyst

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		Bay Point, CA 94565 USA CAGE-33564	
C01-171	Sealant, Accelerator PR715	Courtaids Aerospace 5454 San Fernando Road Post Office Box 1800 Glendale, California 91203 USA Phone (818) 240-2060 Fax (818) 549-7771	Storage life : 12 months when stored between 40 and 80°F (4 and 27°C) in original unopened container.

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C02-001	Compound, Anti-Seize MIL-T-5544		NOTE : (C02-058) may be used as an alternate to assure graphite purity.
	Fel-Pro-C601		Deleted. Replaced by (C02-001) Graphite 50.
	Grahite 50	Fel-Pro Inc., Co. 7450 N. McCormick Blvd. Skokie, IL 60076 USA FSCM 73165	
	Nyco GA47	Nyco SA 66 Avenue Des Champs Elysees Paris 75008 France	
	Royco 44	Royal Lubricants Co., Inc. P.O. Box 518 215 Merry Lane East Hanover, NJ 07936 USA FSCM 07950	Royco 44 available in lb cans. Does not have a flash pt. Not considered restricted for shipment by any form

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			of trans. No shelf life est. Suggest analysis on representative sample after storage for more than two or three yrs.
	Shell Compound No. 8 (Not available in U.S.)	Shell International Trading Co. International Aviation Division Shell Centre London SE1 England	
C02-002	Replaced by (C02-001) or (C02-058)		
C02-003	Lubricant, Sprayable Air Drying	Dow Corning Europe SA 62, rue General De Gaulle Brussels Belgium Ph: 32(2) 655 21 11 Fx: 32(2) 655 20 01	
	Molykote D 321 R	Dow Corning France SA Le Britannia 20, bd Eugene Derwelle 69432 Lyon CEDEX 03 France Ph: 33 478 60 51 48 Fx: 33 478 62 78 98	
C02-004	Lubricant, Sprayable Air Drying		
	Sandstrom 27A (GE Spec A50TF192 Class B) Mo S2 Base and Corrosion Inhibitor	Sandstrom Products Co. 224 Main St. Port Byron, IL 61275 USA FSCM-34227	(Sandstrom 27A) Min order is 1 aerosol can. Normally pkd 12/case. Carton size is 9 x 8.75 x 11.25 in. (229 x 222.3 x 285.8 mm)

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			high Rqr shipper's certificate for restricted articles. Rqr green non-flammable gas label. Up to 150 lbf. (68.03 kg) may be sent on a passenger plane. 1 yr shelf life. Do not expose to heat or store at temp above 120°F (49°C).
	Tiolube 70 Organic Solvent Base, Dry Film Lubricant	Tiodize Co., Inc., 5858 Engineer Dr. Huntington Beach, CA 92649 USA GAGE Code 87887	Available in spray or brush-on application.
	Tiolube 75/ 75 Water Base, Dry Film Lubricant	Tiodize Co., Inc., 5858 Engineer Dr. Huntington Beach, CA 92649 USA GAGE Code 87887	Available in brush-on application only.
	Surfkote A-1625 (GE Spec A50TF192 Class A) Mo S2 Base MIL-L-23398	Hohman Plating & Mfg., Inc., 814 Hillrose Ave Dayton, OH 45404 USA	(Surfkote) 12 oz (0.35l) aerosol cans, 12/case. Bulk liq is pkgd in qt (0.9l) and gal (3.8l) metal cans. Normally shipped by truck as red label hazardous matl. Air trans is by cargo trans only. Flash pt is 73°F (23°C). Store in cool well ventilated area away from open flame or

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			heat producing device. Storage temp not to exceed 120°F (49°C). Max shelf life is 12 mo.
	Zip-D-5460 NS (GE Spec A50TF192 Class C) Mo S2 Collodial Suspension	Zip Chem Products, Co. 1860 Dobbin Dr. San Jose, CA 95133 USA	
C02-006	Lubricant, Everlube ESNA 382	E/M Lubricants, Inc. 6940 Farmdale No. Hollywood, CA 91605 USA	Product will not burn. No flash pt. Store in cool, dry area. Shelf life is 6 mo.
C02-007	Ultrachem Assembly Fluid No. 1 (GE Spec A50TF92)	Ultrachem, Inc. 900 Centerpoint Blvd. New Castle, DE 19720 USA	Pkgd in 4 oz plastic tubes, 1 lb cans, 7 lb cans, 55 gal steel drums. Combustive. Flash pt 400°F (204°C). Std normal storage.
C02-008	Petroleum Jelly Petrolatum VV-P-236	Local Purchase or use C02-033 as alternate material	
C02-014	Grease, Molybdenum Disulphide Aeroshell Grease 17 (MIL-G-21164)	Shell Oil Co. One Shell Plaza Houston, TX 77002 USA FSCM-93508	Min qty of six 5 lb (2.27 kg) cans/case or one 35 lb (15.88 kg) can.
	Aeroshell 33M	Shell Oil Co. One Shell Plaza Houston, TX 77002 USA FSCM-93508	Available in 14 oz. (0.40 kg) tubes, 6.6 lb (3 kg) cans, or 37.5 lb (17 kg) cans.
	Royco 64	Royal Lubricants Co., Inc. P.O. Box 518	Available in 8 and 14 oz. (0.23 and 0.40 Kg)

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		215 Merry Lane East Hanover, NJ 07936 USA FSCM 07950	cartridges also in 1, 5, and 35 lb (0.45, 2.27 and 15.88 kg) containers. Store in cool area away from flame.
	M-Everlube 211-G	LPS Laboratories, Inc. P.O. Box 105052 Tuckov, GA 30085 USA	Available in 1, 5 and 35 lb cans. Flash point is greater than 204°C (400°F).
C02-015	Grease, Molybdenum Disulphide (MIL-G-21164)		Deleted. Use (C02-014).
C02-016	Grease, Aero Shell 7 (MIL-G-23827)	Shell Oil Co. One Shell Plaza Houston, TX 77002 FSCM-93508	Min qty of six 5 lbf. (2.27 kg) cans/case or one 35-lbf (15.88 kg) can.
-016	Grease Exxon S114EP		No longer available.
-016	Grease Castrol EASE A1	Castrol Industrial North America Inc. Specialty Products Division 1001 W. 31st St. Downers Grove, IL 60515 USA	Shelf life (min storage stability) is 2 yr from the date of mfg if stored under normal ambient temp.
-016	Royco 27	Royal Lubricants Co., Inc. P.O. Box 518 215 Merry Lane East Hanover, NJ 07936 USA FSCM 07950	
C02-018	Oil, Penetrating		
	WD-40	WD-40 Company 1061 Cudahy Place San Diego, CA 92110 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C02-019	Oil, Engine (GE Spec D50TF1)		See CF6 Service Bulletin 79-1 for approved oil brands and supplier.
C02-020	Oil, Lubricant, High Temp Silicone base with MOS2 DOD-L-25681 ROYCO MS681	Royal Lubricant Co., Inc. P.O. Box 518 215 Merry Lane East Hanover, NJ 07936 USA FSCM 07950	
C02-021	Oil, Grade 1010		
	Brayco 460	Castrol Industrial North America Inc. Specialty Products Div. 1001 W. 31st St. Downers Grove, IL 60515 USA	
	Hydrocol Jet	Delta Petroleum Inc. 10352 River Road St. Rose, LA 70087 USA	
	Royco 481 (Aeroshell Turbine Oil II)	Royal Lubricants Co., Inc. P.O. Box 518 215 Merry Lane East Hanover, NJ 07936 USA FSCM 07950	
	Windsor L-110	Fuchs Lubricants Co. 17050 Larthrop Ave. Harvey, IL 60426 USA	
C02-023	Oil, Engine Lubricating MIL-L-23699		See CF6 Service Bulletin 79-1 for approved oil brands and supplier.
C02-025	Oil,		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Preservation Per MIL-C-6529C		
	Brayco 483	Castrol Industrial North America Inc. Specialty Products Div. 1001 W. 31st St. Downers Grove, IL 60515 USA	
	Royco 483 (Shell Storage Oil 3)	Royal Lubricants Co., Inc. P.O. Box 518 215 Merry Lane East Hanover, NJ 07936 USA FSCM 07950	
C02-027	Lubricant, Solid Film, Heat Cured Dag 254	Acheson Colloids Compagny Post Office Box 611747 1600 Washington Ave Port Huron, Michigan 48061-1747 USA FSCM/CAGE 70079	Container sizes : 1 quart, 5 gallon, 1 gallon, Flammable liquid : Flash point 46°F (8°C) Shelf life : 6 months
C02-032	Anti-Seize Compound, High Temp.		
	Fel-Pro C5A	Fel-Pro Inc., Div. of Felt Products Mfg. Co. 7450 N McCormick Skokie, IL 60076 USA	1 and 4 oz tubes, 10 oz can, 16 oz aerosol, 1, 2 1/2 and 10 lb cans, 50 lb pail and a 500 lb drum. No limitations or hazards. Flash pt 310°F (154°C) ASTM D92-57. Std. storage.
C02-033	Petrolatum, Soft (Fed-Spec VV-P-236)		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Alternate (C02-008)		
	White Fonoline	Witco Corp. One American Lane Greenwich, CT 06831 USA FSCM-79394	Bulk form only.
		Ruger Chemical Co. 837 Cordier St. Irvington, NJ 07111 USA	One gal (3.8 liter) and 5 gal (18.8 liter) pails or one lb and seven lb jars
C02-050	Oil, Preservation (MIL-L-6085)	Local Purchase	
C02-051	Inhibitor, Corrosion (GE Spec D50TF6#CLASS-A) Brayco 599	Castrol Industrial North America Inc. Specialty Products Div. 1001 W. 31st St. Downers Grove, IL 60515 USA FSCM-98308 Ph: (213) 890-4420 or (800) 590-9855 Fx: (213) 890-4707	
C02-052	Replaced by (C02-050)		
C02-053	Oil, Penetrating		Approved alternatives are C02-026 and C02-039
	Aerokroil (Aerosol)	Kano Laboratories	
	Kroil (Liquid)	Kano Laboratories	
	LPS-1	LPS Laboratories, Inc.	
	LPS-LST	LPS Laboratories, Inc.	
	Supertect ST-A	Roly International	
	Turbinade TA-A	Roly International	
C02-057	Lubricant, Dry	Dow Corning	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Solid Film Dow Corning 3400A	Corporation Post Office Box 997 Midland, Michigan 48686 USA FSCM 94499 Phone (517) 796-6000	
C02-058	Compound, Anti-Seize (GE Spec A50TF201 Class A)		Synthetic Graphite version of MIL-T-5544
	Acheson GP 460	Acheson Colloids Co. 1600 Washington Ave. P.O. Box 611747 Port Huron, MI 48061 USA CAGE 70079	
C02-060	Anti-Seize and Lubricating Compound Never-Seize, GE Spec D6Y28A1		
	Never-Seize Regular Grade Lithium Base	Applied Industrial Technologies 1761 Tennessee Ave. Cincinnati, OH 45229 USA Bostic, Inc. Domestic Sales 211 Boston Street Middletown, MA 01949 USA Bostic, Inc. International Sales 211 Boston Street Middletown, MA 01949 USA	
C02-071	Compound, Anti-Seize		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	(GE Spec D6Y28C1 or A50TF198)		
	Never-Seez Pure Nickel Special Grade	Bostik, Inc (Domestic Sales) 211 Boston Street Middleton, MA 01949 USA	
C02-078	Lubricant, Paste Molykote G-n Paste (USA) (GE Spec A50TF313, Class C)	Aerospace International Materials (AIM) 264 Center Street Miamiville, OH 45147 USA Ph: 513-831-2938 Fx: 513-831-3859 CAGE 0Y7E4	
	Alternate (C02-003)		
	Alternate (C02-085)		
R C02-079	Cal Lube 7030 Lubricant Liquid Thread GE Spec A50TF310 Class A	Calvary Chemical Corp. 9233 Seward Rd. Fairfield, OH 45014-5407 USA Phone : 513 874 1113 Fax : 513 860 6184	
C02-090	Lubricant, O-ring	Novagard C662	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C03-001	Primer, Zinc Chromate		
	TT-P-1757 (AMS 3110) Color Y, Composition G	Local Purchase	
C03-002	Primer, Epoxy		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Resin, (GE Spec A50TF107 CLASS-B) (Dip Type)		
	Deleted, see (C03-005) (spray type) as a possible alternative		
C03-004	Enamel, Polyurethane Chemglaz 11, White A276	Lord Corp Chemical Products Group. 2000 W. Grandview Blvd. Erie, PA 16514 FSCM-30675	
C03-005	Primer, Epoxy Resin Spray Type (GE Spec A50TF107 Class A)		
	463-12-8	T.C. Specialties, Inc. 460 Industrial Way Placentia, CA 92870 USA	Min size kits are qt. Max size kits are drums. Matls are red label and considered flammable. Flash pt is 28°F (-2°C) TCC. Storage should be 40-90°F (4°-32°C).
C03-006	Compound, Chem, Surface Treatment Corrosion Resistant (MIL-C-5541)		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Yellow		
	Alodine No. 1200		Obsolete. Replaced by (C03-006) Alodine 1200S and 1200SRTU.
	Alodine 1200S Alodine 1200SRTU Alodine 1201	Henkel Surface Technologies 32102 Stephenson Hwy. Madison Heights, MI 48071 USA	12, 60, 175 lb nonreturnable containers. 12 lb can, 60 lb pail, 175 lb drum. DOT proper shipping name oxidizer N.O.S. DOT hazardous class and label-oxidizer.
	Alochrom 1200	ICI Paints Div. Wexham Road Slough, Berkshire SL2 5DS U.K.	DOT proper shipping name oxidizer N.O.S. DOT hazardous class and label-oxidizer.
C03-007	Primer, Epoxy BR-127	Cytec Engineered Materials Inc. Product Referral Office 5 Garret Mountain Plaza West Paterson, NJ 07424 USA	
C03-017	Primer, Polyamide Epoxy MIL-P-23377		
	P-527D Primer, C-527D Converter	Kop-Coat, Inc. P.O. Box 911207 Commerce, CA 90091 USA	Type I, Yellow Type II, Green
	Dexter 10-P20-13,	T.C. Specialties, Inc. 460 Industrial Way	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Catalyst EC-213 Type I Class 2	Placentia, CA 92870 USA	
C03-023	Coloring Pigment		
	V1747 (Black)		Deleted. Replaced by (C03-023) 61-860700 (Black)
	61-860700 (Black)	Ferro Corp. Color Division 1301 North Flora Plymouth, IN 46563 USA	
C03-024	Paint, Intumescent (GE Spec A50TF121 CLASS A) Flame Control (No. 170) (Formely 1001-98, mod 8)	Flame Control Coating Inc. P.O. Box 786 4120 Hyde Park Blvd Niagara Falls, NY 14302 USA	Shelf life is 12 mo when stored at 55°-95°F (13°-35°C) in unopened con- tainers.
C03-025	Paint, Intumescent Flame control No. 190 Top Coat	Flame Control Coatings Inc. P.O. Box 786 4120 Hyde Park Blvd Niagara Falls, NY 14302	Shelf life is 12 mo when stored at 55°-95°F (13°-35°C) in unopened con- tainers.
C03-045	Turcoat 4178		Obsolete. Replaced by C03-006.
C03-056	Paint, Epoxy Flat Gray Color #36231		
	MIL-C-22750	Local purchase	
	4222T36231	T.C. Specialties, Inc. 460 Industrial Way Placentia, CA 92870 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C03-057	Reducer Epoxy Paint Thinner		
	TL29	T.C. Specialties, Inc. 460 Industrial Way Placentia, CA 92870 USA	
C03-059	Polyurethane Paint, Gray Glossy		
	BAC-707 Topcoat X-310A Catalyst	T.C. Specialties, Inc. 460 Industrial Way Placentia, CA 92870 USA	
C03-060	Paint, Epoxy Topcoat, Black Conductive Coating BMS 10-21, Type II or Type III		
	10-P2-3 and Catalyst EC-110 (Type III)	T.C. Specialties, Inc. 460 Industrial Way Placentia, CA 92870 USA	
	538C306 and Activator 910X464 (Type II) 528X310 and Activator 910X464 (Type III)	Courtaulds Aerospace Sealants, Adhesives, and Coatings 5430 San Fernando Rd. Glendale, CA 91203 USA	
C03-062	Thinner, Epoxy Paint		
	Sikkens, TL 52	T.C. Specialties, Inc. 460 Industrial Way Placentia, CA 92870 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C03-063	Primer, Epoxy (Green) 515X349-Base 910X533-Activator	Courtaulds Aerospace Sealants, Adhesives and Coatings 5430 San Fernando Road Glendale, CA 91203 USA	
C03-071	Coating, Temporary Alkaline Removable Leeder 321-N	Brent America Inc. 16961 Knott Ave. La Mirada, CA 90638 USA FSCM 23373	
C03-081	Conversion Coating, Chromated Alodine 1200SRTU	Henkel Surface Technologies 32102 Stephenson Hwy. Madison Heights, MI 48071 USA	
C03-082	Conversion Coating, Chromated Alodine 1201 (MIL-C-5541) Yellow	Henkel Surface Technologies 32102 Stephenson Hwy. Madison Heights, MI 48071 USA	
C03-084	Conversion Coating, Chromated Alocrom 1200 Brush	ICI Paints Division Wexham Road Slough, Berkshire SL2 5DS United Kingdom	Mixing required.
C03-085	Primer, Epoxy, Yellow Zinc Phosphate (EMPIS Spec. A8B94A1) Seymour Hi Tech 16-897	Seymour of Sycamore 917 Crosby Avenue Sycamore, IL 60178 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C04-001	Solvent, Methyl-Ethyl-Ketone	Local purchase	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	(MEK) (ASTM D 740) Alternate, (C04-160) or (C04-196)		
C04-002	Solvent, Stoddard (P-D-680 Type I or Type II)	Local purchase	
C04-003	Solvent, Acetone (Fed. Spec. O-A51)	Local purchase	
C04-004	Solvent, Trichloroe- thylene, Technical (Fed. Spec. O-T-634)	Local purchase	
C04-005	Solvent, Chlorothene NU (Fed. Spec. O-T-620a)		Obsolete. Ozone depleting Substance
	Solvent, Triethane (Fed. Spec. O-T-620a)		Obsolete. Ozone depleting Substance
C04-009	Rust Remover, Alkaline		
	Turco T-4181 Turco T-4181L	Elf Atochem Turco Products 2375 State Road Cornwells Heights, PA 19020 USA FSCM 61102	Pkgd in 125 lb kegs and 450 lb drums. Pkd in approved ICC containers. Can be sent via truck, rail, ship, railway express, parcel post (if in a suitable container) anywhere within the continental limits of the United States.
	Turco T-4181 Turco T-4181L	Export only : Elf Atochem North	Store in dry area with

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		America Turco Aviation Products 2000 Market St. Philadelphia, PA 19103 USA	container cover tightly closed.
C04-014	Alcohol, Denatured	Local Purchase	
C04-018	Naptha, Fed. Spec.		
	TTN-95 Type II	Local Purchase	
C04-026	Coke, Powdered Jet Shot L340 (GE Spec D50TF7)	J.S. McCormick 650 Smithfield St. Suite 1050 Pittsburgh, PA 15222 USA	
R C04-028	Compound, Cleaner, Coconut Oil, Coco 15	Misco Products Corporation Reading, PA (800) 548-4568 FAX (610) 926-1194 www.miscoprod.com	
C04-030	Trichloroethane 1.1.1 Technical Inhibited (O-T-620-C) or Mil-T-81533		Deleted. Ozone depleting Substance.
C04-035	Alcohol, Isopropyl	Local Purchase	
C04-043	Cleaner, Compound Liqui-Steam (T5279A)	Elf Atochem Turco Products 2375 State Road Cornwells Heights, PA 19020 USA	5 gal (18.8 liter) drum, 55 gal (208 liter) drum, DOT storage temp. 0-130°F (-18-54°C) ten months min. shelf life.
		Export only : Elf Atochem North America Turco Aviation Products 2000 Market St. Philadelphia, PA 19103 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C04-044	Cleaner, Compound Intex 8102 (Liquid)	Intex Products, Inc. P.O. Box 6648 Greenville, SC 29606 USA	Pkg min. is a five gal (18.8 liter) pail. Available in one gal (3.8 liter) plastic containers six cases. Also available in 55 gal (208 liter) drums (537 lb). Trans - no restrictions. Shelf life - no restrictions.
C04-045	Cleaning Compound		
	Aerosteam No. 20 (Liquid)		No longer available
	Sprex AC-3 (Powder)		No longer available
	C1102 (Liquid)	Dubois Chemical Co. 255 E 5th St. Cincinnati, OH 45202 USA	55 gal (208 liter) metal drum 537 lb gross, 492 lb net. Flash pt by the tag open cup method - none. Avoid freezing temp. Normal storage.
C04-076	Remover, Paint Turco "Super Carb"	Elf Atochem Turco Products 2375 State Road Cornwells Heights, PA 19020 USA	55 gal (208 liter) drum. DOT C-4 damage by freezing. Storage temp 32-90°F (0-49°C). Flash pt none to boiling (TCC). Six months shelf life.
		Export only : Elf Atochem North America Turco	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		Aviation Products 2000 Market St. Philadelphia, PA 19103 USA	
C04-102	Solvent, Toluene Regeant Grade	Local Purchase	(Moisture not to exceed 0.15 percent by weight)
C04-140	Gas Path Cleaner, Liquid MIL-C-85704, Type I, II, and IIA		
	B and B 3100, Type I B and B TC-100, Type II	B and B Tritech Inc. P.O. Box 660-776 Miami, FL 33266-0776 USA CAGE 58913	
	Turboclean (Ardrox 6366) and Turboclean 2 (Ardrox 6367, Type II, and 6368 Type I)	Brent America, Inc. 16961 Knott Ave La Mirada, CA 90638 USA CAGE 23373	
	T5884, Type I	Elf Atochem Turco Products 2375 State Road Cornwells Heights, PA 19020 USA Export only : Elf Atochem North America Turco Aviation Products 2000 Market St. Philadelphia, PA 19103 USA	
	ZOK27-CON, Type II ZOK27-RTU, Type II	Europe : Airworthy Ltd. Elsted, Midhurst GU 29 0JT England	6.6 gal (25 liter) containers 55.5 gal (210 liter) drums, 264.2 gal (1,000 liter) totes

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	MIL-C-85704, Type II		
		Zok, Inc. 8226 Kerr St. Houston, TX 77029 USA CAGE 02ZK3	5 US gal (18.8 liter) pails, 55 US gal (208 liter) drums, 320 US gal (1211 liter) returnable totes
	R-MC Engine Cleaner 4072 Type IIA 4070 Type II	ECT Inc. Bridgeport Business Park BLDG 20 401 E. 4th St. Bridgeport, PA 19405 USA	
	MA 109C (Type II) MA 110RTU (Type IIA)	JAD Chemical Co. P.O. Box 6786 Rancho Palos Verdes, CA 90734 USA	
C04-151	Alcohol, Isobutyl	Local Purchase	
C04-160	Solvent, MEK Base		Solvent wipe cleaner, available as MEK, substitute, alternate for C04-001
	Ardrox 1064-K	Brent America, Inc. 16961 Knott Ave. La Mirada, CA 90638 USA FSCM 23373 PH: (714) 739-2821 FX: (714) 670-6480	
C04-170	Solvent, General MIBK (Methyl Isobutyl Ketone)	Local Purchase	
C04-196	Solvent, Methyl-Propyl-Ketone	Local purchase	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C04-258	Cleaner/Lubricant, Electrical Contact Pro Gold GX100L Pro Gold GX5L	Caig Laboratories, Inc. 12200 Thatcher Ct. Poway, CA 92064 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C05-002	Ink, Marking Dykem (Steel Blue - DX100)	ITW-Dykem Co. 3624 W. Lake Ave. Glenview, IL 60025 USA FSCM-98148	Pkgd in 1/2 oz and 1 oz bottles; 4 oz and 8 oz cans; pt qt and gal cans, 16 oz spray cans. Shipping wt sizes under 4 oz, less than 1/2 lb, 8 oz 3/4 lp, pt 1 1/2 lb, qt 2 3/4 lb, gal 9 lb, spray cans 1 1/4 lb. Keep away from heat and flame - no limitation on shelf life.
C05-003	Marking Pens		
	T.E.C. Marker (Black)	Sanford Corp. 2711 Washington Blvd. Bellwood, IL 60104 USA	Normal Storage Shelf life is indefinite This is the lot controlled version of the Sharpie Fine Point No. 30001.
	Berol Verithin Silver Pencil	Sanford Corp. 2711 Washington Blvd. Bellwood, IL 60104 USA	
	LN9051 Red or Blue	Ratioplast GmbH Spitalwald Strasse Be 9	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		8540 Schwabach, West Germany	
	Black or White D50TF8		
	Action Marker Nuclear Grade White or Black No. 33, 44, and 55 tip	Mark-Tex Corp. 160 W. Forest Ave. Englewood, NJ 07631 USA	Felt tip No. 33 fine tip No. 44 medium tip No. 55 broad tip
	#55 Valve Action Marker #Y-608 Black Water Removable Ink	Mark-Tex Corp. 160 W. Forest Ave. Englewood, NJ 07631 USA	
C05-005	Leak-Tek 16-OX (ASTM E515)	American Gas & Chemical Company, Ltd. 220 Pegasus Ave. Nonthvale NJ 06747 USA FSCM-03530	4 oz (0.12l) squeeze 12/carton, polyethylene 8 oz (0.24l) squeeze 12/carton, polyethylene 10 oz (0.3l) aerosol, 12/carton gal (3.8l) carboys, 4/carton polyethylene, 5 gal (18.8l) carboys, 1/carton polyethylene 55 gal (208l) drums polyetlylene. Non-flammable, water based chemical specialty product. Std storage. Shelf life is approx 1 yr.
C05-023	Penetrant		
	ZL22A		Obsolete. Replaced by

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			(C05-023) ZL27A
	ZL27A	ITW Fluids Inc.- Magnaflux 3624 W. Lake Ave. Glenview, IL 60025 USA	1 gal (3.8 liter), 5 gal (18.8 liter) and 55 gal (208 liter) containers, combustible liq, no labels req. Max qty is one pkg. Passenger air, cargo air and passenger rail - no lim. Shelf life is six mo - one yr with no continuous thawing and freezing.
C05-061	Developer		
	ZP4A		Obsolete. Replaced by (C05-061) ZP4B or ZP14A.
	ZP4B or ZP14A	ITW Fluids Inc.- Magnaflux 3624 W. Lake Ave. Glenview, IL 60025 USA	Hazard type - none. Pkgs in 10 lb and 25 lb bags and pt cans. Shelf life is six mo to one yr. Avoid continuous thawing and freezing.
	Ardrox 9D1B		Chemetall Oakite/ Division of Chemetall GmbH.
C05-100	ZL7 Developer		Obsolete.
C07-007	Tungsten Carbide 12 % Cobalt Aggregate (GE Spec B50TF27,		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Class A)		
	Bay State PP75	Bay State/Sterling Inc. 12 Union St. Westborough, MA 01581 USA	
	Metco 72F-NS	Sulzer Metco, Inc. 1101 Prospect Ave. Westbury, NY 11590 USA	
	PAC 127	Powder Alloy Corp. 5871 Creek Road Cincinnati, OH 45242 USA	
	WC114	Praxair Specialty Products 1555 Main Street Indianapolis, IN 46224 USA	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C10-001	Desiccant MIL-D-3464 Type I	Local Purchase	
C10-003	Fabric Glass Tape No. 181 (MIL-C-9084, Type VIII or VIIIA)	Hexcel Corporation 11711-21 Dublin Rd. Dublin, CA 94566 USA FSCM-04621	
C10-008	Honeycomb Core, Phenolic Reinforced Polyamide Fiber HRH-10-3/8-3.0 (Specify 3/8 in. thickness and desidered length	Hexcel Corp. 5794 W. Las Positas Blvd. Pleasanton, CA 94588 USA	Cardboard boxes size determined by order size. Normal trans by truck. Able to fly depending on size sheets ordered. Std. storage. 0.375 in. (9.53 mm) cell x 0.375 in.

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	and width)		(9.53 mm) thick Density : 3 lb/ft3
C10-009	Paper, Grease-proof, Grade A, Type 2, Class 2 (Kraft)	Ludlow Co. Packaging Div. P.O. Box 749 1 Miden Rd. Homer, LA 71040 USA FSCM-76209	Pkg is in rolls approx 12 in. (305 mm) OD and either 36 (914 mm) or 48 in. (1219 mm) wide. There are no restrictions on trans of this product. It will burn, however, wound in a tight roll, it does not readily support combustion.
C10-010	Abrasive Pads, Scotch Brite No. 7447 (6 x 9 1/2 in.)	Minnesota Mining and Mfg. Co. Industrial Coated Abrasives Div. 3M Center St. Paul, MN 55144 USA FSCM-28124	60 pads/case Case size 7 x 10 x 21 in. (177.8 x 254.0 x 533.4 mm) long. Not harmful or flammable. Any type of routing acceptable. Std. storage.
C10-011	Compound Mold Release MS-143N		Deleted. Replaced by (C10-011) 143DF
	143DF Alternate (C10-013)	Miller-Stephenson Chem. Co., Inc. George Washington Hwy P.O. Box 950 Danbury, CT 06810 USA FSCM-18598	Min order is one gal. Pkgd in one, five and 55 gal metal containers. Non-flammable Shelf life is one yr from date of shipment. Do not store near source of heat, in

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			direct sunlight or where temp exceeds 120°F (49°C).
C10-012	Tape, Masking High Temperature		
	Bron #1864-8R-GE	Bron Tapes 845 Navajo Street Denver, CO 80204 USA	
	Fluorglas 2905-7 Tape #9710 Fluorglas 2975-8R	Furon 14 McCaffrey St Hoosick Falls, NY 12090 USA	
	D/W 410	DeWal Industries 15 Ray Trainor Dr. P.O. Box 372 Saunderstown, RI 02874 USA	
	Fiberglass Tape 23816 Metal Tape 26020	Furon 14 McCaffrey St. Hoosick Falls, NY 12090 USA	For orders outside the USA, use CHR Furon 407 East St. New Haven, CT 06509-9988 USA
C10-013	Compound Release Agent		
	MS-122N/C02 Fluoro-carbon		Deleted. Replaced by (C01-013) MS-122DF
	MS-122DF Alternate (C10-011)	Miller-Stephenson Chem. Co., Inc. George Washington Hwy P.O. Box 950 Danbury, CT 06810 USA	Min order, four aerosol cans. There are 12 cans/case. Non-flammable. Shelf life is one

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
		FSCM-18598	yr from date of shipment. Do not store near source of heat, in direct sunlight or where temp exceeds 120°F (49°C). Do not puncture or damage containers.
	MS-122V Alternate (C10-011)	Miller-Stephenson Chem. Co., Inc. George Washington Hwy P.O. Box 950 Danbury, CT 06810 USA FSCM-18598	MS-122V is non-chlorinated and is not considered an ozone depleting substance.
C10-022	Additive, Fumed-Silica Viscosity Control Agent		
	Cab-O-Sil		Obsolete. Replaced by Cab-O-Sil TS-720
	Cab-O-Sil TS-720	Cabot Corporation 700 E. U.S. Hwy. 36 Tuscola, IL 61953 USA	
C10-029	Seal, Conical VSF1015-N-4	Fairfield Fasteners 3000 West Lomita Blvd. Torrence, CA 90505 USA	Min order is 100 pieces. Pkgd in polyethylene strips. Each strip contains 10 pockets with 1 seal per pocket. Depending on size of order, 10 or more strips would be pkgd in a corrugated box. One or more of these boxes would then be pkgd together in an add corrugated container. Special requirement

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			is the parts are to be handled with care to prevent damage. Std normal storage - no limitation on shelf life.
C10-030	Vibration Dampening Material Unisorb HB-1/2 (Sheet 1/2 in. x 3 ft. x 5 ft.)	Unisorb Installation Technologies P.O. Box 1000 4117 Felters Road Jackson, MI 49201 USA	Sheet size - 36 x 60 x 0.5 in. (914 x 1524 x 13 mm). Std corrugated paper boxes sealed with asphalt tape. Sizes vary with individual pieces with the max 36 x 60 x 1.5 in. (914 x 1524 x 38 mm) No special trans considerations are reqd. Dry std cond.
C10-040	Tape, Teflon 1 x 0.002 in. thick, Scotch Brand 5490	Minnesota Mining and Mfg. Co. Industrial Tape Div. 3M Center St. Paul, MN 55101 USA FSCM-26066	Size - 1 x 0.002 in. (25 x 0.05 mm). No deterioration after normal storage of 1 yr
C10-054	Gun, Heat	Grainger Parts Branch 138 820 N. Orleans Chicago, IL 60610 USA	
C10-068	Gun, Sealant Semco Model 250-A6, P/N 250065	PRC-Desoto International Inc. 5430 San Fernando Road Glendale, CA 91209 USA	
C10-070	Tape, Glass Fiber (GE Spec	Permacel U.S. Highway No. 1 New Brunswick, NJ 08903	1,000 Volt Dielectric breakdown strength

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	A23B5A2) Permacel P21	USA	
	Scotch No. 27	3M Company Electrical Products Div. BLDG A130-3N 6801 River Place Blvd. Austin, TX 78726 USA FSCM-26066	
	Tuck No. 51		Deleted. Replaced by (C10-070) TESA 4616.
	TESA 4616	TESA Tape Inc. (TTI) 5825 Carnegie Blvd. Charlotte, NC 28209 USA	
C10-071	Safety wire AMS5685, (305 stainless steel) AMS5687 (Inconel 600) AMS5689 (321 stainless steel) AMS5690 (316 stainless steel) 0.020 or 0.032 inch (0.51 or 0.81 mm) dia	Allied Signal 1160 South St. Suffield, CT 06078 USA	
C10-093	Filler Phenolic Micro- balloons Type BJO-0930	Asia Pacific Microspheres (manufacturer) SDN BHD P.O. Box 7086 40702 Shah Alam Selangor Darul Ehsan, Malaysia	Min order is 17 lb bag or 50 lb drum. Trans - no labels reqd. No flash pt available. Shelf life is indefi- nite if kept out of

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
			sunlight and away from heat. Also used in (C01-060).
		The M.F. Cachat Co. 1391 W. 110th St. Cleveland, OH 44102 USA	
C10-105	Abrasive, Sandpaper Roll, 120 Grit, Aluminum Oxyde	Local Purchase	
C10-108	Brush, Disposable, Natural Bristle, Cat. No. 7237T4 (or equivalent) Cat. No. 7798T2 (or equivalent)	MC Master Carr 600 County Line Road Elmhurst, IL 60126 USA Phone : 630 833 6300 Fax : 630 834 9427	
C10-112	Fabric, High Stength Woven Graphite 12.5 x 12.5 tows/in. (GE Spec. A50TF211, Class B) W-322	Cytex Fiberite 4300 Jackson St. Greenville, TX 75401 USA	Type - 12.5 x 12.5 tows/in. (318 x 318 tows/mm)
C10-113	Honeycomb Core, Phenolic Reinforced Polyamide Fiber HRH-10-1/8-3.0 (Specify 1/2 in. Thickness and desired Length and Width)	Hexcel Corp. First City Bank Bldg 201 E. Abram Suite 300 Arlington, TX 76010 USA	0.125 in. (3.18 mm) cell x 0.5 in. (13 mm) thick Density 3 lb/ft3
C10-116	Filler Graphite Fibers, Milled		
	Thornel Mat VMD Thornel Mat VMX-11	Amoco Polymers Inc. 4500 McGinnis Ferry Alpharetta, GA 30005 USA	Available in 5 lb and 50 lb plastic bags. May cause skin irritation. Avoid

	Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
				contact by using gloves and a respirator
	C10-120	Abrasive Paper, Aluminum Oxyde, 320 Grit	Local Purchase	
	C10-121	Abrasive Paper, Silicon Carbide Wet/Dry 320 Grit	Local Purchase	
	C10-122	Cloth, Glass, AMS3824A, MIL-Y-1140, Style 120, Finish 538	BGF Industries 3802 Robert Porcher Way Greensboro, NC 27410 USA	Must specify the width
R	C10-125	Tape, Silicone Self-Adhering (GE PN 3003M70)	D & B Industrial 2-4 Cedar Creek Ave. Georgetown, DE 19947 USA Phone : 302 855 0585 Fax : 302 855 0588	0.020 in. (0.51 mm) thick nominal
R		Tape, Silicone Self-Adhering 920-07 (GE PN 3003M70)	Arlon, Inc. Silicone Technologies Division 1100 Governor Lea Rd. Bear, DE 19701 USA Phone : 800 635 9333 Alt Phone 302 834 2100 Fax : 302 834 4021	0.020 in. (0.51 mm) thick nominal 0.75 in. (19.05 mm) wide
R		Tape, Silicone Self-Adhering 920-10 (GE PN 3003M70)	Arlon, Inc. Silicone Technologies Division 1100 Governor Lea Rd. Bear, DE 19701 Phone : 800 635 9333 Alt Phone 302 834 2100 Fax : 302 834 4021	0.020 in. (0.51 mm) thick nominal 1.00 in. (25.40 mm) wide
R		Tape, Silicone Self-Adhering MIL Style A-A-59163	Marian, Inc. 1011 E. St. Clair St. Indianapolis, IN 46202	0.020 in. (0.51 mm) thick nominal

	Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
R		Type 1	USA Phone : 317 638 6525 Fax : 317 638 8664	0.50 in. (12.70 mm) wide or 1.00 in. (25.40 mm) wide
R		MOX-Tape 620-5	Flexfab 1699 W. M-43 Hwy Hastings, MI 49058 USA Phone : 800 331 0003 Alt Phone : 616 945 2433 Fax : 616 945 4802 Email : sales[at] flexflab.com	0.020 in. (0.51 mm) thick nominal 0.50 in. (12.70 mm) wide
	C10-128	Plastic Sheet, Polyethylene	Local Purchase	1.5 mil thickness or greater
	C10-133	Film, Polymer FEP, Un-perforated 0.001 in. (0.03 mm) thick A4000	Airtech International Inc. 5700 Skylab Road Huntington Beach, CA 92647 USA	
		48 or 56 in. width A5000	Richmond Aircraft Prod. 13503 Pumice St. Norwalk, CA 90650 USA	
	C10-140	Gloves, Film Latex or Nylon/ Polyethylene Disposable	Local Purchase	
	C10-141	Abrasive Paper	Local Purchase	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	120 Grit, SiC, wet/dry		
	180 Grit, SiC, wet/dry		
C10-143	Safety Cable Assembly	Daniels Mfg. Corp. 526 Thorpe Rd Orlando, FL 32824 GAGE 11851 USA	
		Bergen Cable Technologies, Inc. 170 Gregg St. Lodi, NJ 07644 GAGE 70958 USA	
C10-144	Ferrule, Safety Cable J1286P01 (347 or 321 Stainless Steel)	Bergen Cable Technologies, Inc. 170 Gregg St. P.O. Box 1300 Lodi, NJ 07644 USA	Pkgd in quantities of 50 in a plastic magazine dispenser for use with 0.032 in. dia wire.
	J1286P03	Daniels Mfg. Corp. 526 Thorpe Rd Orlando, FL 32824 USA	Pkgd in quantities of 50 in a plastic magazine dispenser for use with 0.032 in. dia. wire.
C10-145	Cable, Safety Cable J1285P01 (321 Stainless Steel) 0.032 in. dia	Bergen Cable Technologies, Inc. 170 Gregg St. P.O. Box 1300 Lodi, NJ 07644 USA	Cable with swaged ferrule attached.
	J1285P03	Daniels Mfg. Corp. 526 Thorpe Rd Orlando, FL 032824 USA	Cable with swaged ferrule attached
C10-146	Test Block, Safety		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Cable		
	TB101	Bergen Cable Technologies, Inc. Post Office Box 1300 170 Gregg St. Lodi, NJ 07644 USA	
	CTK202		Deleted. Replaced by (C10-146) JRC 202.
	JRC 202	Snap-On Industrial Solutions 1100 - 91st St. Kenosha, WI 53143-6978 USA	CTK202-2 Table Clamp is also available.
	SCT-TB1	Daniels Mfg. Corp. 526 Thorpe Road Orlando, FL 32824 USA	
C10-147	Tester, Safety Cable		
	MPT-200ASC	Monitor Manufacturing, Inc. Alphatron Division P.O. Box 8048 Elburn, IL 60119 USA	N-1001 Carrying Case is also available.
		Bergen Cable Technologies, Inc. 170 Gregg St. P.O. Box 1300 Lodi, NJ 07644 USA	
	SCT-ET1	Daniels Mfg. Corp. 526 Thorpe Road Orlando, FL 32824 USA	
C10-148	Crimping		

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
	Tool, Safety cable (0.032 in. dia wire)		
	M303X3	Bergen Cable Technologies, Inc. 170 Gregg St. P.O. Box 1300 Lodi, NJ 07644 USA	3.0 in. (76.2 mm) extension for use with TASK 70-11-02-400-006, Safety Cable Procedure Method 1.
	M307X7	Bergen Cable Technologies, Inc. 170 Gregg St. P.O. Box 1300 Lodi, NJ 07644 USA	7.0 in. (177.8 mm) extension for use with TASK 70-11-03-400-007, Safety Cable Method 1 (Bergen Tool)
	CTK8V32A		Deleted. Replaced by (C10-148) JRC8V32C
	JRC8V32C	Snap-On Industrial Solutions 1100-91st St. Kenosha, WI 53143-6978 USA	For use with TASK 70-11-04-400-008, Safety Cable Method 2 (Snap-On Tool)
	SCT323	Daniels Mfg. Corp. 526 Thorpe Road Orlando, FL 32824 USA	3.0 in. (76.2 mm) extension for use with TASK 70-11-05-400-009, Safety Cable Method 3 (Daniels (DMC) Tool)
	SCT327	Daniels Mfg. Corp. 526 Thorpe Road Orlando, FL 32824 USA	7.0 in. (177.8 mm) extension for use with TASK 70-11-05 400-006, Safety Cable Method 3 (Daniels (DMC) Tool)
C10-149	Wire Cutter, Flush Side Cushioned	Local Purchase	

Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
C10-182	Cloth, Cleaning For Aircraft Structural (SAE-AMS 3819, BMS 15-5)		
	900-0000 (12 in. x 21 in.)		Obsolete. Replaced by 900-1217
	900-0044 (4 in. x 8 in.)		Obsolete.
	Kamen 900-1217 Kamen 900-99	Kamen Wiping Materials Co., Inc. 441 N. Santa Fe P.O. Box 2077 Wichita, KS 67201-2077 USA	
C10-187	Abrasive Cloth, Aluminum Oxide (Super Flexible)	3M Company 3M Center, Bldg, 304-0101 St. Paul, MN 55144 USA Phone : 800 364 3577 Alt Phone : 651 737 6501 Fax : 800 713 6329 Alt Fax : 651 737 7117	3M 211K (For grit sizes 80, 100, 120, 150, 180, 220, 240 and 320). 3M 241K (For grit sizes 36, 50 and 60).
C10-191	Abrasive Paper, Silicon Carbide Wet/Dry 600 Grit	Local Purchase	
R C10-206	Tape, Glass, Lacing and Tying (A-A-52083, Size 2) 402-3/5X	Breyden Products, Inc. 17485 Catalpa Suite B-2 Hesperia, CA 92345 USA Phone : 760 244 7948 Fax : 760 244 6704	
R	Tape, Glass, Lacing and Tying (A-A-52083, Size 2)	Western Filament, Inc. 630 Hollingsworth Dr. Grand Junction,	

	Ref No.	Description	Manufacturer	Packaging Shelf Life and Remarks
R			CO 81505	
R			USA	
R		P/N 190L0F21R	Phone : 970 241 8780	
R			Fax : 970 241 8682	
R			Email : wfi[at] wfilament.com	
	C10-211	Abrasive Cloth, (Medium) Scotch Brite Pads No. 7440 (6.0 x 9.5 in.)	3M Company	
	C10-230	Tape, PTFE Film, Silicone Adhesive (A-A-59474 Type 1, Class 4)	3M Company	Tape 61 (1.0 in. wide)
			Permacel	P-421 (1.0 in. wide)
			Permacel	P-421 (1.5 in. wide)

CONSUMABLE LOCATION REFERENCES

Ref. No.	References Location in MM
C01-006	72-21-00, P. Block 801
	72-22-00, P. Block 801
	72-23-00, P. Block 801
	72-31-00, P. Block 801
	73-21-01, P. Block 501
	77-31-09, P. Block 401
C01-007	71-52-01, P. Block 201
	71-52-01, P. Block 401
	72-23-00, P. Block 801
	72-32-00, P. Block 601
	72-32-00, P. Block 801
	78-31-00, P. Block 201
	78-32-00, P. Block 601
	78-32-00, P. Block 801
	78-32-00, P. Block 901
R C01-008	78-32-00, P. Block 601
C01-011	72-22-00, P. Block 801
	72-23-00, P. Block 801
	72-24-00, P. Block 801
	78-32-00, P. Block 601

	Ref. No.	References Location in MM
		78-32-00, P. Block 801 78-32-12, P. Block 401
	C01-014	72-21-00, P. Block 801
R	C01-015	78-32-00, P. Block 601
	C01-017	72-22-00, P. Block 801
	C01-018	72-22-00, P. Block 801
	C01-024	72-22-00, P. Block 801
	C01-025	72-00-00, P. Block 201
	C01-030	72-23-00, P. Block 801
	C01-031	72-23-00, P. Block 801
	C01-049	75-32-01, P. Block 801 79-11-00, P. Block 501
	C01-055	72-00-00, P. Block 601
	C01-056	72-21-00, P. Block 801 72-22-00, P. Block 801 72-23-00, P. Block 801
	C01-057	72-21-00, P. Block 801
	C01-060	72-22-00, P. Block 801
	C01-062	78-32-00, P. Block 601
	C01-073	78-31-01, P. Block 401 78-31-03, P. Block 401 78-31-51, P. Block 401 78-32-00, P. Block 901 78-32-13, P. Block 401
	C01-077	78-31-12, P. Block 801
	C01-080	78-32-00, P. Block 801
	C01-084	72-24-00, P. Block 801
	C01-087	78-31-03, P. Block 801 78-31-51, P. Block 801

Ref. No.	References Location in MM
C01-092	75-32-01, P. Block 801 79-11-00, P. Block 801
C01-106	72-22-00, P. Block 601 78-32-00, P. Block 601 78-32-00, P. Block 801 79-22-00, P. Block 801
C01-115	78-31-01, P. Block 401 78-31-03, P. Block 401 78-31-51, P. Block 401 78-32-00, P. Block 801 78-32-00, P. Block 901
C01-116	78-32-00, P. Block 801
C01-117	78-32-00, P. Block 801
C01-126	78-32-00, P. Block 801
C01-129	78-32-00, P. Block 801
C01-145	78-32-00, P. Block 401
C01-147	72-22-00, P. Block 801 78-32-00, P. Block 401
C01-155	78-32-00, P. Block 601 78-32-00, P. Block 801
C01-171	78-31-03, P. Block 401 78-32-11, P. Block 401

CONSUMABLE LOCATION REFERENCES

Ref. No.	References Location in MM
C02-001	71-21-00, P. Block 401 72-23-00, P. Block 801 72-32-00, P. Block 801 72-58-03, P. Block 401 72-58-05, P. Block 401
C02-002	77-31-02, P. Block 401

Ref. No.	References Location in MM
C02-003	72-21-00, P. Block 601 72-21-00, P. Block 801
C02-004	72-23-00, P. Block 801 72-32-00, P. Block 601 72-32-00, P. Block 801
C02-006	72-00-00, P. Block 501 72-21-00, P. Block 801 72-22-00, P. Block 801 72-23-00, P. Block 801 77-11-01, P. Block 401
C02-007	72-60-00, P. Block 801 72-65-01, P. Block 801
C02-008	73-21-01, P. Block 801 72-21-00, P. Block 801 72-23-00, P. Block 801 72-24-00, P. Block 801
C02-014	12-22-78, P. Block 1 78-31-02, P. Block 401
C02-015	78-31-02, P. Block 401
C02-016	12-22-78, P. Block 301 78-31-02, P. Block 401
C02-018	78-32-00, P. Block 601
C02-019	12-13-24, P. Block 301 24-11-18, P. Block 401 72-00-00, P. Block 201 72-21-00, P. Block 401 72-21-00, P. Block 801 72-21-01, P. Block 401 72-24-00, P. Block 801 72-58-05, P. Block 401 72-63-00, P. Block 401 72-64-00, P. Block 401 72-64-00, P. Block 801 72-65-00, P. Block 801 72-67-00, P. Block 401 72-67-00, P. Block 801 73-12-01, P. Block 401

Ref. No.	References Location in MM
	73-12-03, P. Block 401
	75-23-02, P. Block 401
	77-12-01, P. Block 401
	77-31-07, P. Block 401
	77-34-04, P. Block 401
	78-36-07, P. Block 401
	78-36-08, P. Block 201
	79-00-00, P. Block 601
	79-11-00, P. Block 401
	79-11-00, P. Block 801
	79-21-07, P. Block 401
	79-22-01, P. Block 401
	79-22-03, P. Block 401
	80-13-01, P. Block 401
	80-13-01, P. Block 601
C02-020	71-11-00, P. Block 401
	72-23-00, P. Block 801
	78-11-02, P. Block 401
C02-021	72-00-00, P. Block 201
	72-00-00, P. Block 501
	73-12-01, P. Block 401
	73-12-02, P. Block 401
	73-12-03, P. Block 401
	73-21-01, P. Block 401
	73-21-01, P. Block 501
	73-21-02, P. Block 401
	73-21-02, P. Block 601
	73-21-07, P. Block 401
	73-23-06, P. Block 401
	73-31-11, P. Block 401
R	73-33-11, P. Block 901
	75-23-03, P. Block 401
	75-31-08, P. Block 401
	75-32-01, P. Block 401
	77-31-08, P. Block 501
	77-31-09, P. Block 501
	79-22-02, P. Block 401
C02-023	12-13-80, P. Block 301
	24-11-25, P. Block 401
	24-11-26, P. Block 401
	24-11-29, P. Block 401
	24-11-30, P. Block 401
R	70-00-00, P. Block 201

Ref. No.	References Location in MM
	73-31-11, P. Block 401 73-34-11, P. Block 401 79-32-00, P. Block 401 79-33-11, P. Block 401 79-35-11, P. Block 401
C02-025	72-00-00, P. Block 201
C02-027	78-31-01, P. Block 401 78-31-03, P. Block 401 78-31-51, P. Block 401 78-32-11, P. Block 401
C02-032	78-31-12, P. Block 401 78-32-00, P. Block 801
C02-033	72-65-00, P. Block 501 72-00-00, P. Block 601 72-21-00, P. Block 801 72-58-02, P. Block 401 72-58-03, P. Block 401 72-58-05, P. Block 401
Alt	72-65-00, P. Block 801 73-13-01, P. Block 401
(See C02-008	75-23-01, P. Block 401
C02-050	72-00-00, P. Block 701
C02-051	72-00-00, P. Block 201 72-00-00, P. Block 701
R C02-053	77-21-00, P. Block 501 77-21-01, P. Block 401 77-21-04, P. Block 401
C02-057	78-31-01, P. Block 401 78-31-03, P. Block 401 78-31-51, P. Block 401 78-32-11, P. Block 401
C02-058	70-00-00, P. Block 201 71-22-00, P. Block 401 72-00-00, P. Block 201 72-00-00, P. Block 501 72-00-00, P. Block 601 72-21-00, P. Block 801

Ref. No.	References Location in MM
	72-23-00, P. Block 801
	72-24-00, P. Block 801
	72-32-00, P. Block 601
	72-32-00, P. Block 801
	72-34-00, P. Block 601
	72-41-00, P. Block 601
	72-56-00, P. Block 601
	72-57-00, P. Block 601
	72-58-02, P. Block 401
	72-58-03, P. Block 401
	72-58-05, P. Block 401
	73-12-01, P. Block 401
	73-21-01, P. Block 401
	73-23-00, P. Block 401
	77-21-04, P. Block 401
	77-32-04, P. Block 401
	78-31-09, P. Block 201
	79-21-01, P. Block 401
C02-060	71-00-00, P. Block 401
	71-21-00, P. Block 401
R	77-21-00, P. Block 501
	77-21-01, P. Block 401
	77-21-04, P. Block 401
	78-32-00, P. Block 801
C02-071	72-00-00, P. Block 601
C02-078	72-21-00, P. Block 401
	72-21-00, P. Block 601
C02-079	77-21-04, P. Block 401

CONSUMABLE LOCATION REFERENCES

Ref. No.	References Location in MM
C03-001	78-32-00, P. Block 801
C03-002	78-32-00, P. Block 801
C03-004	78-32-00, P. Block 601
C03-005	78-32-00, P. Block 601
	78-32-00, P. Block 801
R C03-006	72-65-00, P. Block 601

Ref. No.	References Location in MM
	78-31-00, P. Block 201 78-31-13, P. Block 801 78-32-00, P. Block 601 78-32-00, P. Block 801 78-36-01, P. Block 201
C03-017	24-11-26, P. Block 401
C03-023	75-32-01, P. Block 801 79-11-10, P. Block 801
C03-024	78-32-00, P. Block 601
C03-025	78-32-00, P. Block 601
C03-045	78-36-01, P. Block 201
C03-056	78-32-00, P. Block 801
C03-057	78-32-00, P. Block 801
C03-059	78-32-00, P. Block 801
C03-060	78-32-00, P. Block 801
C03-062	78-32-00, P. Block 801
C03-063	78-32-00, P. Block 801
C03-071	10-10-30, P. Block 1
C03-081	72-22-00, P. Block 801
R	72-23-00, P. Block 601
C03-082	72-22-00, P. Block 801
R	72-23-00, P. Block 601
C03-084	70-71-01, P. Block 1 72-22-00, P. Block 801
C03-085	72-22-00, P. Block 801

CONSUMABLE LOCATION REFERENCES

Ref. No.	References Location in MM
C04-001	71-70-21. P. Block 201 72-00-00, P. Block 501 72-00-00, P. Block 601 72-00-00, P. Block 701 72-21-00, P. Block 401 72-21-00, P. Block 801 72-22-00, P. Block 801 72-23-00, P. Block 801 72-31-00, P. Block 801 72-32-00, P. Block 801 77-31-09, P. Block 401 78-31-12, P. Block 801 78-32-00, P. Block 401 78-32-00, P. Block 601 78-32-00, P. Block 801 78-32-00, P. Block 901 79-00-00, P. Block 601
C04-002	70-00-00, P. Block 201 71-00-00, P. Block 501 72-00-00, P. Block 701 72-22-00, P. Block 801 72-24-00, P. Block 801 73-21-01, P. Block 501 73-21-02, P. Block 401 74-21-01, P. Block 601 74-21-02, P. Block 401 75-31-08, P. Block 401 77-11-01, P. Block 601 77-12-01, P. Block 601 77-31-09, P. Block 501 78-31-09, P. Block 201 79-00-00, P. Block 701 79-21-01, P. Block 401
C04-003	72-21-00, P. Block 401 72-22-00, P. Block 801 72-24-00, P. Block 801 78-31-06, P. Block 201 78-32-00, P. Block 601 78-32-00, P. Block 901
C04-004	73-21-02, P. Block 401 75-32-01, P. Block 801 78-31-12, P. Block 801 78-32-00, P. Block 401 79-11-00, P. Block 801

	Ref. No.	References Location in MM
		79-21-01, P. Block 401
		79-22-03, P. Block 401
		79-22-03, P. Block 601
	C04-005	72-22-00, P. Block 801
		72-23-00, P. Block 801
		72-24-00, P. Block 801
	C04-009	73-11-01, P. Block 701
	C04-014	78-32-00, P. Block 801
	C04-018	71-70-00, P. Block 201
	C04-026	72-00-00, P. Block 701
R	C04-028	70-00-00, P. Block 201
R		
	C04-030	72-32-00, P. Block 801
		78-32-00, P. Block 801
		79-21-01, P. Block 401
	C04-035	12-13-80, P. Block 1
		70-71-01, P. Block 1
		72-00-00, P. Block 701
		72-21-00, P. Block 401
		72-21-00, P. Block 801
		72-22-00, P. Block 801
R		72-65-00, P. Block 601
R		73-13-03, P. Block 601
R		73-33-11, P. Block 901
		77-21-00, P. Block 501
		77-21-01, P. Block 401
		77-21-04, P. Block 401
		77-32-01, P. Block 601
		77-32-03, P. Block 601
		77-32-04, P. Block 401
		77-32-22, P. Block 601
		78-31-10, P. Block 201
		78-32-00, P. Block 601
		78-32-00, P. Block 801
		78-32-00, P. Block 901
	C04-043	70-00-00, P. Block 201
	C04-044	70-00-00, P. Block 201
	C04-045	70-00-00, P. Block 201

Ref. No.	References Location in MM
C04-076	70-00-00, P. Block 201
C04-077	70-00-00, P. Block 201
C04-102	72-21-00, P. Block 801
C04-132	72-00-00, P. Block 701
C04-151	72-00-00, P. Block 701
C04-160	72-31-00, P. Block 801
C04-170	72-22-00, P. Block 801
C04-258	70-00-00, P. Block 201

CONSUMABLE LOCATION REFERENCES

Ref. No.	References Location in MM
C05-002	78-11-01, P. Block 801
C05-003	72-00-00, P. Block 501 72-32-00, P. Block 801
C05-005	73-13-01, P. Block 401 73-21-02, P. Block 401 73-21-07, P. Block 401 75-31-08, P. Block 401 75-32-01, P. Block 401 78-31-06, P. Block 201
C05-023	79-00-00, P. Block 601
C05-061	36-11-12, P. Block 401 36-11-13, P. Block 401 36-11-14, P. Block 401 36-11-15, P. Block 401 36-11-17, P. Block 401
C05-100	79-00-00, P. Block 601
C07-007	78-11-01, P. Block 801

CONSUMABLE LOCATION REFERENCES

Ref. No.	References Location in MM
C10-001	72-00-00, P. Block 201
C10-003	72-22-00, P. Block 801
C10-008	72-22-00, P. Block 801
C10-009	72-00-00, P. Block 201 72-65-00, P. Block 801 78-32-00, P. Block 801
C10-010	70-00-00, P. Block 201 70-71-01, P. Block 1 72-00-00, P. Block 701 78-32-00, P. Block 801
C10-012	72-00-00, P. Block 701 72-24-00, P. Block 801 72-58-03, P. Block 401
C10-013	72-23-00, P. Block 801 72-32-00, P. Block 801
C10-022	72-22-00, P. Block 801
C10-030	72-00-00, P. Block 201
C10-040	72-22-00, P. Block 801 72-32-00, P. Block 801
C10-054	72-22-00, P. Block 801
C10-068	72-22-00, P. Block 801
C10-070	78-31-12, P. Block 801
C10-071	12-13-14, P. Block 301 12-13-80, P. Block 301 24-11-29, P. Block 401 29-11-66, P. Block 401 30-21-09, P. Block 401 71-00-00, P. Block 401 71-22-01, P. Block 401 71-40-00, P. Block 401 72-00-00, P. Block 701 72-32-00, P. Block 801 72-56-00, P. Block 801 72-58-04, P. Block 401
R	72-65-00, P. Block 801

Ref. No.	References Location in MM
	73-17-04, P. Block 401
	73-21-01, P. Block 401
	73-21-02, P. Block 401
	73-21-07, P. Block 401
	73-33-11, P. Block 401
R	73-33-11, P. Block 901
	74-11-01, P. Block 701
	74-21-01, P. Block 401
	74-21-02, P. Block 401
	75-31-01, P. Block 401
	75-32-01, P. Block 401
	76-11-62, P. Block 401
	77-11-01, P. Block 401
	77-21-03, P. Block 401
	77-21-04, P. Block 401
	77-31-02, P. Block 401
	77-31-03, P. Block 401
	77-31-04, P. Block 401
	77-31-05, P. Block 401
	77-31-07, P. Block 401
	77-31-08, P. Block 401
	77-31-09, P. Block 401
	77-31-09, P. Block 501
	77-31-09, P. Block 501
	77-32-04, P. Block 401
	78-31-00, P. Block 501
	78-31-00, P. Block 901
	78-31-01, P. Block 401
	78-31-03, P. Block 401
	78-31-05, P. Block 401
	78-31-06, P. Block 201
	78-31-09, P. Block 201
	78-31-10, P. Block 201
	78-31-12, P. Block 401
	78-31-13, P. Block 401
	78-32-00, P. Block 901
	78-32-11, P. Block 401
	78-36-07, P. Block 401
	78-36-08, P. Block 401
	78-36-09, P. Block 201
	79-00-00, P. Block 301
	79-00-00, P. Block 601
	79-11-00, P. Block 401
	79-11-00, P. Block 801
	79-21-01, P. Block 401
	79-22-01, P. Block 401
	79-22-02, P. Block 401
	79-22-03, P. Block 401

	Ref. No.	References Location in MM
		79-31-11, P. Block 401 79-32-00, P. Block 401 79-35-11, P. Block 401
	C10-105	78-32-00, P. Block 801
	C10-108	72-22-00, P. Block 801
	C10-112	78-32-00, P. Block 801
	C10-113	78-32-00, P. Block 801
	C10-116	72-23-00, P. Block 801
	C10-120	70-71-01, P. Block 1
	C10-121	70-71-01, P. Block 1
	C10-122	78-32-00, P. Block 601
R	C10-125	73-33-11, P. Block 901
	C10-128	72-00-00, P. Block 201
	C10-133	72-22-00, P. Block 801
	C10-140	72-22-00, P. Block 801 78-32-00, P. Block 801
	C10-141	72-22-00, P. Block 801 78-32-00, P. Block 801
	C10-143	72-58-04, P. Block 401
	C10-144	70-00-00, P. Block 201
	C10-145	70-00-00, P. Block 201
R		
	C10-146	70-00-00, P. Block 201
	C10-147	70-00-00, P. Block 201
	C10-148	70-00-00, P. Block 201
	C10-149	70-00-00, P. Block 201
R		73-33-11, P. Block 901

	Ref. No.	References Location in MM
	C10-182	72-22-00, P. Block 801
	C10-187	72-22-00, P. Block 801
	C10-191	70-71-01, P. Block 1
R	C10-206	73-33-11, P. Block 901
	C10-211	70-71-01, P. Block 1
R	C10-230	73-13-03, P. Block 601

POWER PLANT WIRING STANDARD PRACTICES - SEQUENCING
DESCRIPTION AND OPERATION

1. General

A. All data in chapter/section 70-71 are related only to the General Electric CF6 Power Plant only.

SUBJECT	CH-SE-SU
General	70-71-01
Specification of cables	70-71-11
Wire Splice Repairs	70-71-12

B. For additional information refer to :

AMM 71-50-00 Electrical Harness

AMM 78-31-13 Fan Reverser Electrical Cable Assy

R 1. General

R All data in chapter/section 70-71-01 are related to the General Electric CF6 Power Plant only.

R 2. Reason for the Job

R The root cause of many engine problems have often been traced to an intermittent electrical fault. The information contained in this section contains general cleaning, inspection, and installation practices required whenever an electrical harness, electrical connector, and/or electrical component is removed or installed. Following the maintenance practices in this section will assist in the discovery of any intermittent electrical faults during trouble-shooting, and ensure electrical components return to service with a secure and reliable connection. If this procedure is followed, many electrical problems will be solved immediately. Experience has shown that significant amounts of harware replacements can occur before the problem is found, if the electrical system is not checked out.

R 3. Equipment and Material

ITEM	DESIGNATION
A.	Soft-Jawed Electrical Pliers
B.	Digital Multi-meter, Low Voltage
C.	Gold-plated Test Leads, 20 Gage
D.	Gold-plated Test Leads, 16 Gage
E. Material No.C03-084	Finishes and Protective Coatings (Ref. 70-00-00)
F. Material No.C04-035	Cleaning Compounds and Solvents (Ref. 70-00-00)
G. Material No.C10-010	Miscellaneous (Ref. 70-00-00)
H. Material No.C10-120	Miscellaneous (Ref. 70-00-00)
or	
Material No.C10-121	Miscellaneous (Ref. 70-00-00)
I. Material No.C10-191	Miscellaneous (Ref. 70-00-00)
J. Material No.C10-211	Miscellaneous (Ref. 70-00-00)
Referenced Procedure	
- 73-21-04, P. Block 601	ECU Cables

R 4. General Conditions

R A. Test Conditions

R Testing measurements shall be performed under the following conditions:

R (1)Ambient Temperature 0°C to 40°C (32°F to 104°F).

R (2)Dry day conditions with no loose or blowing water. Relative humidity less than 80%. If relative humidity is greater than 80% then the 10 Mohm resistance to ground limit in procedure can be reduced to 1 Mohm.

R (3)Following an engine shutdown with a minimum of one hour cool down and no water exposure to harnesses, probes, or LRUs.

R B. Resistance Measurements
R (1)Multimeter test probes and jumper wires must be fitted with gold-plated
R 20 gage (Ref 0.039 in. diameter) or 16 gage (Ref. 0.062 in. diameter)
R electrical connector pins or sockets where applicable. This will prevent
R contamination and damage to the connector contacts when you do circuit
R resistance measurements.
R WARNING : USE THE TEST PROBES WITH INCORRECT DIAMETER WILL PERMANENTLY
R DAMAGE THE RECEPTACLE SOCKETS.
R (2)Resistance measurement to be made using a calibrated, low voltage digital
R type multimeter to minimize the instability in the readings due to the
R heating effects of type K thermocouple junctions.
R (3)Type K thermocouple circuit resistance test values are obtained by
R measuring and recording the circuit resistance test value when stable.
R Reverse test lead polarity, measure and record the circuit resistance
R test value when stable. Average these two readings, and subtract the test
R lead resistance from the averaged reading to obtain the circuit
R resistance.
R (4)During resistance measurements, connector contact areas including
R interfacial seals must be free of dirt, contamination and moisture.
R (5)To duplicate the intermittent fault, mechanically exciting the harness
R by moving the cable by light hand pressure in a slow, circular and
R sideways motion (+/- 0.12 in. displacement) from the existing routing
R during harness electrical resistance checks will be necessary.
R Start it from the furthest end of the circuit, usually is the component
R under test, and work back towards the pylon.

R C. Handling of Electrical Components
R (1)Use caution when handling hardware, removing or installing hardware.
R Some components contain sensitive electrical components that can be
R damaged with rough handling or dropping of harware (accelerometers,
R speed sensors, etc.).

R 5. Procedure

R A. Harness Inspection
R (1)General inspect the entire harness length and circuitry related to the
R circuit under review for the following:
R (a)Wear, chafing.
R 1 Repair or replace the damaged harness.
R 2 If rerouting of the harness is required for alignment or to correct
R for interference, refer to the appropriate installation procedure
R (Ref. Fig. 001).
R (b)Loose connectors.
R 1 Inspect the connector(s) conditions per paragraph 5.B before
R tightening it (them).
R (c)Other defective or loose hardware/circuitry.
R 1 Clean, reassemble, repair or replace defective hardware as required.
R (2)Perform electrical resistance checks in the following order. Resistance
R limits in the troubleshooting manual or aircraft maintenance manual are
R specified per circuit, with a process originally planned for hard faults.
R When a hard fault is not found, effective intermittent circuit

R troubleshooting requires going beyond those recommendations, in the
R following order:
R (a)Multimeter or instrument at the removed connector.
R (b)Measure circuit to circuit and circuit to backshell ground with
R inspections per paragraph 4.B.
R (c)Disconnect connector at the end furthest from the component under test.
R (d)Measure insulation resistance from pin to pin and each pin to
R back-shell ground with inspections per paragraph 4.B.
R (e)If no problems are found, replace harware as recommended in the
R manuals.
R NOTE : Most intermittent faults have been resolved with connector
R cleaning/replacements at the component under investigation.

R B. Connector Inspection
R (1)Connector plug assembly disconnection from engine hardware
R NOTE : Any time a connector assembly is disconnected, clean the
R connector plug and receptacle before reinstalling it.
R Use soft-jawed electrical pliers to loosen the plug assembly
R (Ref. Fig. 002).
R CAUTION : GRIP THE CONNECTOR ONLY ON THE KNURLED RING SHOWN IN
R (Ref. Fig. 002) AND ONLY WITH SOFT-JAWED ELECTRICAL PLIERS.
R FAILURE TO DO SO WILL DAMAGE THE CONNECTOR.
R (a)Remove the plug assembly by pulling straight out by the housing
R (Ref. Fig. 003).
R CAUTION : EXCESSIVE ROCKING AND/OR TWISTING DURING REMOVAL MAY DAMAGE
R THE PLUG AND/OR THE RECEPTACLE.
R CAUTION : ONLY PULL FROM THE PLUG ASSEMBLY HOUSING. PULLING FROM THE
R CABLE MAY DAMAGE THE HARNESS AND/OR CONNECTOR.
R (b)Install protective covers on the open ends of connectors and
R receptacles (Ref. Fig. 004).
R (2)Connector plug inspection
R - Inspect the connector plug assembly for the following:
R (Ref. Fig. 005).
R (a)Dirt
R 1 Clean dirty connectors.
R (b)Oil wetting
R If oil wetting is found, clean the connector. Locate and repair source
R of oil leak.
R (c)Fuel wetting
R If fuel wetting is found, clean the connector. Locate and repair source
R of fuel leak.
R (d)Skydrol hydraulic wetting
R 1 If Skydrol hydraulic contamination is discovered, replace contaminated
R components. Locate and repair source of hydraulic leak.
R (e)Loose backshells
R 1 If backshell is loose:
R - inspect the threads
R - re-tighten backshell
R - re-secure connector
R 2 If damage is too extensive, replace the connector or harness.
R (f)Missing lockwire

R 1 Replace missing lockwire (Ref. Fig. 003).
R (g)Damaged, swollen, and/or missing seals (Ref. Fig. 005). If seal is damaged, swollen, or missing, replace the connector or harness.
R (h)Damaged contacts (Ref. Fig. 005).
R NOTE : If damaged electrical contact(s) are found and cannot be corrected, replace the harness. Inspect mating connector per paragraph 5.B.(3). Not all contacts are active or used in the electrical circuit. It is not uncommon for unused contacts to show evidence of wear and back residue due to gold oxide wear mechanism. This is not cause for removal or replacement.
R 1 Loose contacts.
R 2 Pushed/pulled contacts.
R 3 Worn, burnt or blackened contacts.
R Inspect for loss of gold or buildup of black residue on end and inside diameter of contact for the active circuits in the connector. Wear first occurs on the inside diameter of the socket contact and is not easily visible. Inspect mating receptacle for contact damage. Damaged plating could lead to electrical circuit failures. Look for evidence of black powdery residue on insulator around the contact. Use 10X magnifying glass to perform close-up inspection.
R Clean black powdery residue from the contacts.
R Cracked insulator.
R 4 Improper tension (Ref. 73-21-04, P. Block 601).
R (3)Connector receptacle inspection - Inspect the receptacle for the following:
R (Ref. Fig. 005)
R (a)Dirt.
R (b)Clean dirty receptacle.
R (c)Oil wetting
R 1 If oil wetting is found, clean the receptacle. Locate and repair source of oil leak.
R (d)Fuel wetting
R 1 If fuel wetting is found, clean the receptacle. Locate and repair source of fuel leak.
R (e)Skydrol hydraulic wetting
R 1 If hydraulic contamination is found, replace contaminated components. Locate and repair source of hydraulic leak.
R (f)Damaged pins
R NOTE : If damaged electrical pin(s) are found and cannot be corrected, replace the component. Inspect mating connector per paragraph 5.B.(2). Not all contacts are active or used in the electrical circuit. It is not uncommon for unused contacts to show evidence of wear and back residue due to gold oxide wear mechanism. This is not cause for removal or replacement.
R 1 Bent pins
R - Slightly bent pins can be straightened by gently prying with a non-metallic tube, or mating socket contact. It is not recommended to straighten pins bent greater than two pin diameters, as damage to pin and gold plating may result in future connection failures.

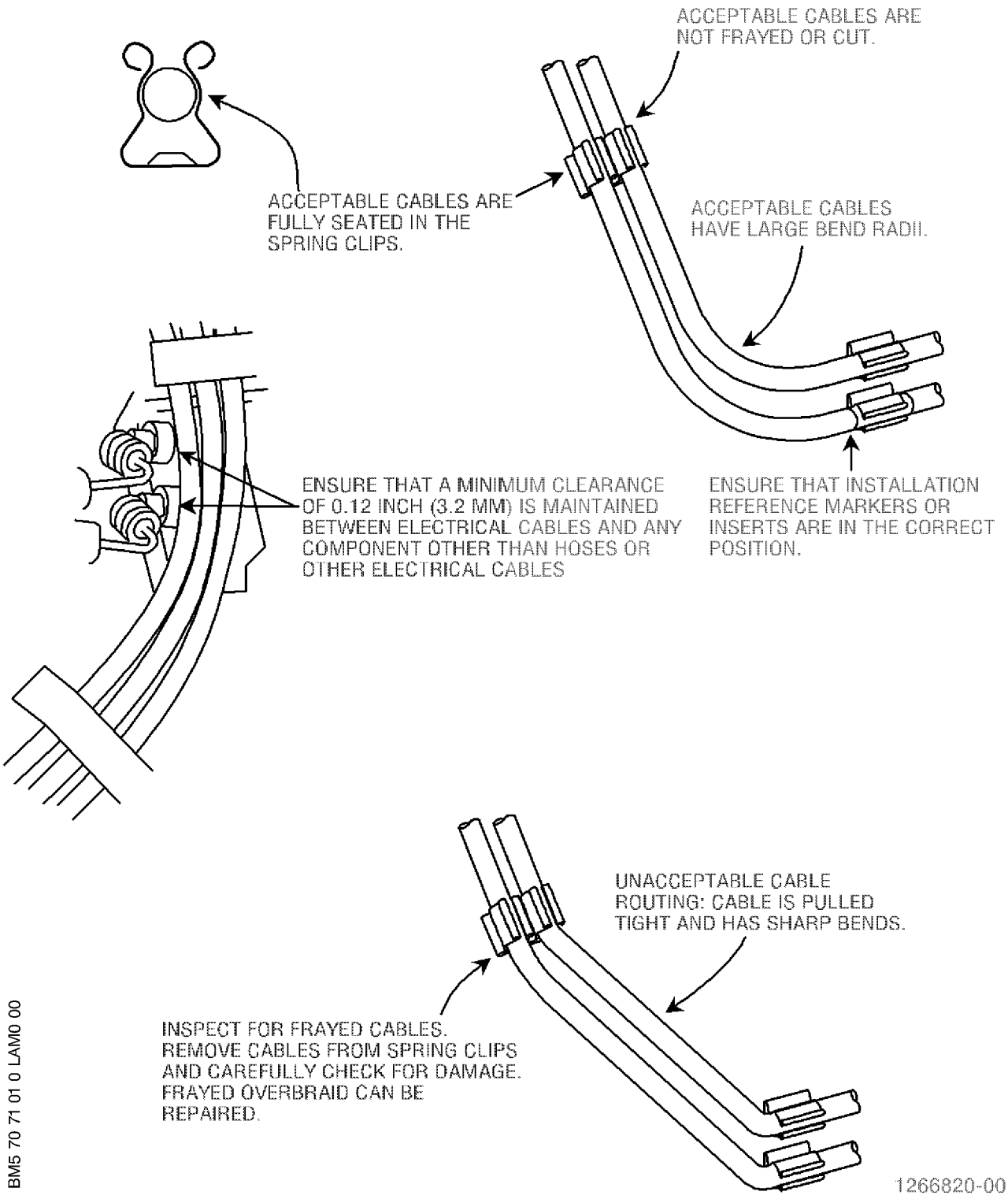
R 2 Pushed/pulled pins
R - There may be unseen internal damage that will not be corrected by forcing the pins into the proper position.
R 3 Missing contacts
R (g)Worn, burnt or blackened contacts. Inspect for loss of gold or buildup of black residue on the outside diameter of the pins for the active circuits in the connector. Damaged plating could lead to electrical circuit failures. Look for evidence of black powdery residue on insulator around the base of the pin or wear on the contact near the base of the pin. Use 10X magnifying glass to perform close-up inspection.
R Clean black powdery residue from the contacts.
R Damaged and/or missing seals (Ref. Fig. 005).
R If seal is damaged, swollen, or missing, replace the receptacle or component.
R (4)Connector installation
R (a)Align the connector and receptacle keyways.
R (b)Install the connector straight in by pushing on the housing.
R CAUTION : EXCESSIVE ROCKING AND/OR TWISTING THE CONNECTOR DURING INSTALLATION MAY DAMAGE THE CONNECTOR AND/OR THE RECEPTACLE.
R (c)Fully tighten the coupling nut by hand (as indicated by the coupling nut covering the color band on the receptacle).
R NOTE : A self-locking feature is included in the coupling ring of the connector. If the clicking action or self-locking feature is missing or damaged, then replace the connector or harness.
R (d)Further tighten the coupling nut with soft-jawed pliers until the pliers slip (approximately 1/8 turn).
R CAUTION : GRIP THE CONNECTOR ONLY ON THE KNURLED RING SHOWN IN (Ref. Fig. 002) AND ONLY WITH SOFT-JAWED ELECTRICAL PLIERS. FAILURE TO DO SO WILL DAMAGE THE CONNECTOR.
R (e)Make sure the connector is tight.
R 1 Try to move the connector backshell assembly with your hand.
R 2 Make sure the assembly does not move.
R 3 If the connector is not tight, retighten the coupling nut with the soft-jawed connector pliers until the pliers slip.
R 4 If the connector will not tighten, check for damage and replace the defective part(s).
R (f)Make sure the work area is clean and clear of tools and miscellaneous items of equipement.

R C. Bonding Straps
R (1)Electrical bonding strap contact surfaces shall be prepared immediately prior to joining by removing all anodic film, grease, paint, lacquer, or other high-resistance material from an area at least one and one-half times the bonding surface contact area.
R (2)Remove any paint and primer from contact areas using the Strong cleaning method per Table 1.
R (3)Remove protrusions, corrosion or high metal from contact area using the Strong cleaning method per Table 1.
R (4)Remove residual aluminum corrosion resistant coating from contact surfaces using the Strong cleaning method per Table 1.

R (5)Inspect for residual corrosion or oxides on grounding strap lug. Clean if necessary.
R (6)Thoroughly clean all surfaces.
R (a)Clean using Light Cleaning method of Table 1.
R (b)If the Light Cleaning method is not effective, use the Strong Cleaning method.
R (7)Apply surface treatment compound (Material No.C03-084) using a nylon brush to the exposed aluminum areas.
R (8)Let surface treatment set for 10 minutes to cure and then remove excess compound by flushing with potable water and brush. Dry with clean, lint free cloth and clean water.
R (9)Install the ground strap lug with its fasteners on the structure or equipment. Align strap onto fastener with smooth bend and avoid kinking the ground strap, and torque assembly to manual recommendation (Ref. Fig. 006).
R (10)Check the resistance across the ground of the connection from the strap to the cleaned surface adjacent to the strap. If resistance between the surfaces is more than 0.0020 ohm, repeat the installation procedure. Anodize film is non-conductive and if metered onto this surface, a false reading for the ground resistance will be incorrect.

Cleaning Method	Aluminum	Nickel, Stainless Steel
Light Cleaning	Wipe with clean, lint-free cloth moistened with iso-propyl alcohol. Carefully polish blemishes out with 600 grit or finer abrasive paper (Material No.C10-191) or Scotch Brite No. 7447 abrasive pad (Material No.C10-010).	Wipe with clean, lint-free cloth moistened with iso-propyl alcohol.
Strong Cleaning	Nonsoluble films should be removed by sanding or polishing with abrasive paper (silicon carbide or aluminum oxide, 320 grit or finer (Material No.C10-120 or No.C10-121) or Scotch Brite No. 7440 abrasive Pad (Material No.C10-211), using caution so as not to remove excessive metal. A small area may be cleaned by using a fine stainless steel wire brush. NOTE : No emery or iron oxide paper or cloth is permitted.	Carefully polish blemishes out with 600 grit or finer abrasive paper (Material No.C10-191) or Scotch Brite No. 7447 abrasive pad (Material No.C10-010). If nickel plating is removed from bonding strap lug, replace the strap.

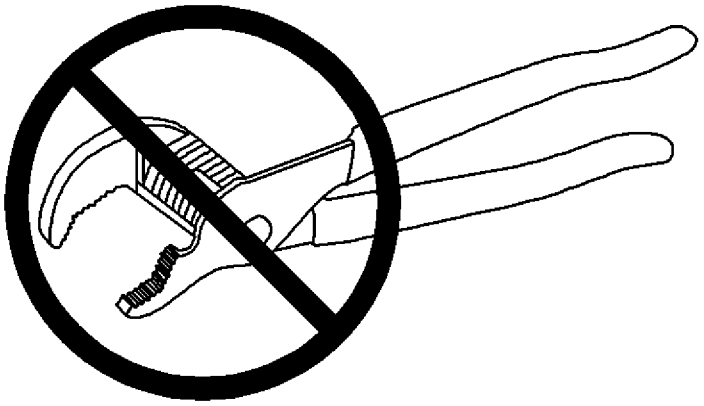
R Grounding Connection Cleaning
R Table 1


ACCEPTABLE CABLES ARE NOT FRAYED OR CUT.
ACCEPTABLE CABLES ARE FULLY SEATED IN THE SPRING CLIPS.
ACCEPTABLE CABLES HAVE LARGE BEND RADII.
ENSURE THAT A MINIMUM CLEARANCE OF 0.12 INCH (3.2 MM) IS MAINTAINED BETWEEN ELECTRICAL CABLES AND ANY COMPONENT OTHER THAN HOSES OR OTHER ELECTRICAL CABLES
ENSURE THAT INSTALLATION REFERENCE MARKERS OR INSERTS ARE IN THE CORRECT POSITION.
UNACCEPTABLE CABLE ROUTING: CABLE IS PULLED TIGHT AND HAS SHARP BENDS.
INSPECT FOR FRAYED CABLES. REMOVE CABLES FROM SPRING CLIPS AND CAREFULLY CHECK FOR DAMAGE. FRAYED OVERBRAID CAN BE REPAIRED.
1266820-00

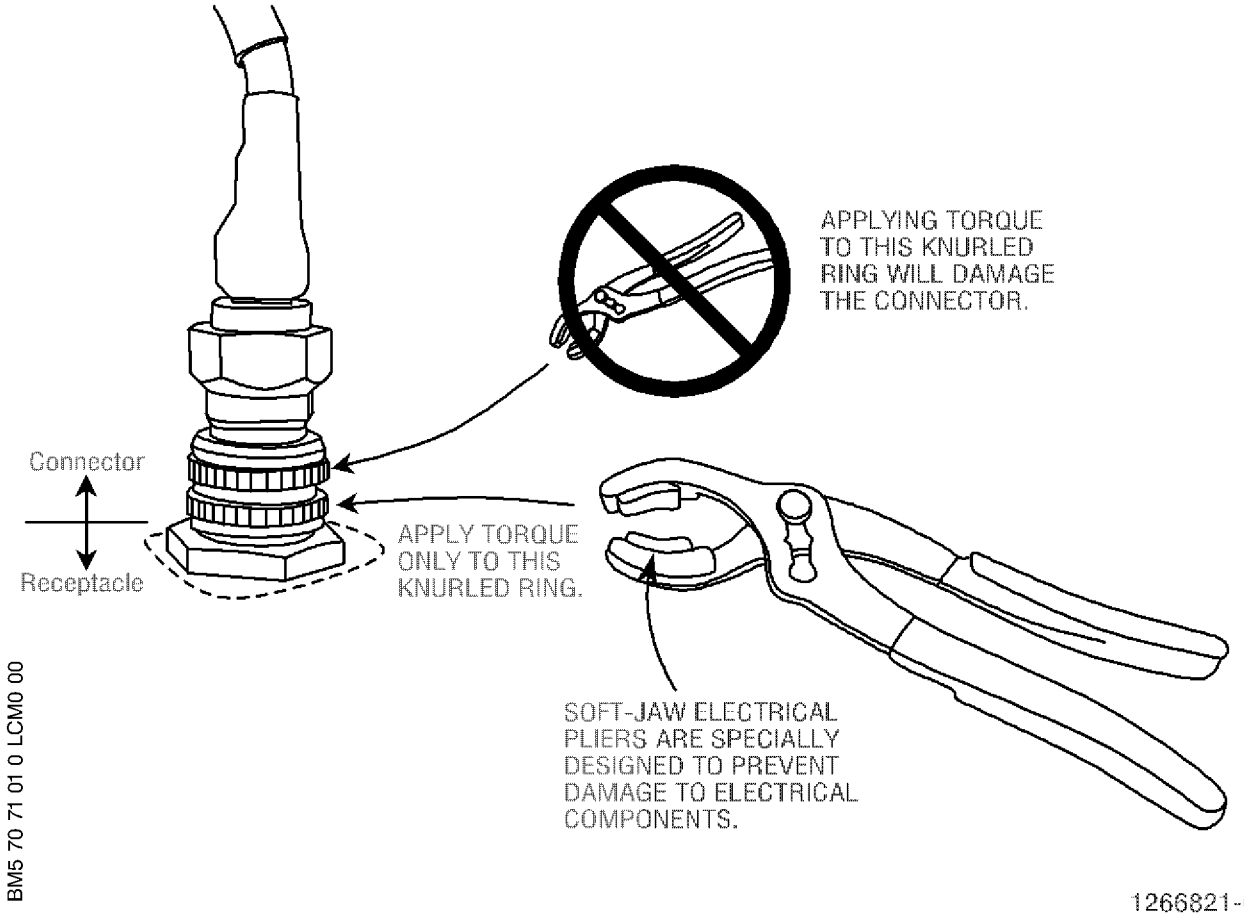
BM5 70 71 01 0 LAM0 00

Cable Inspection
Figure 001

R

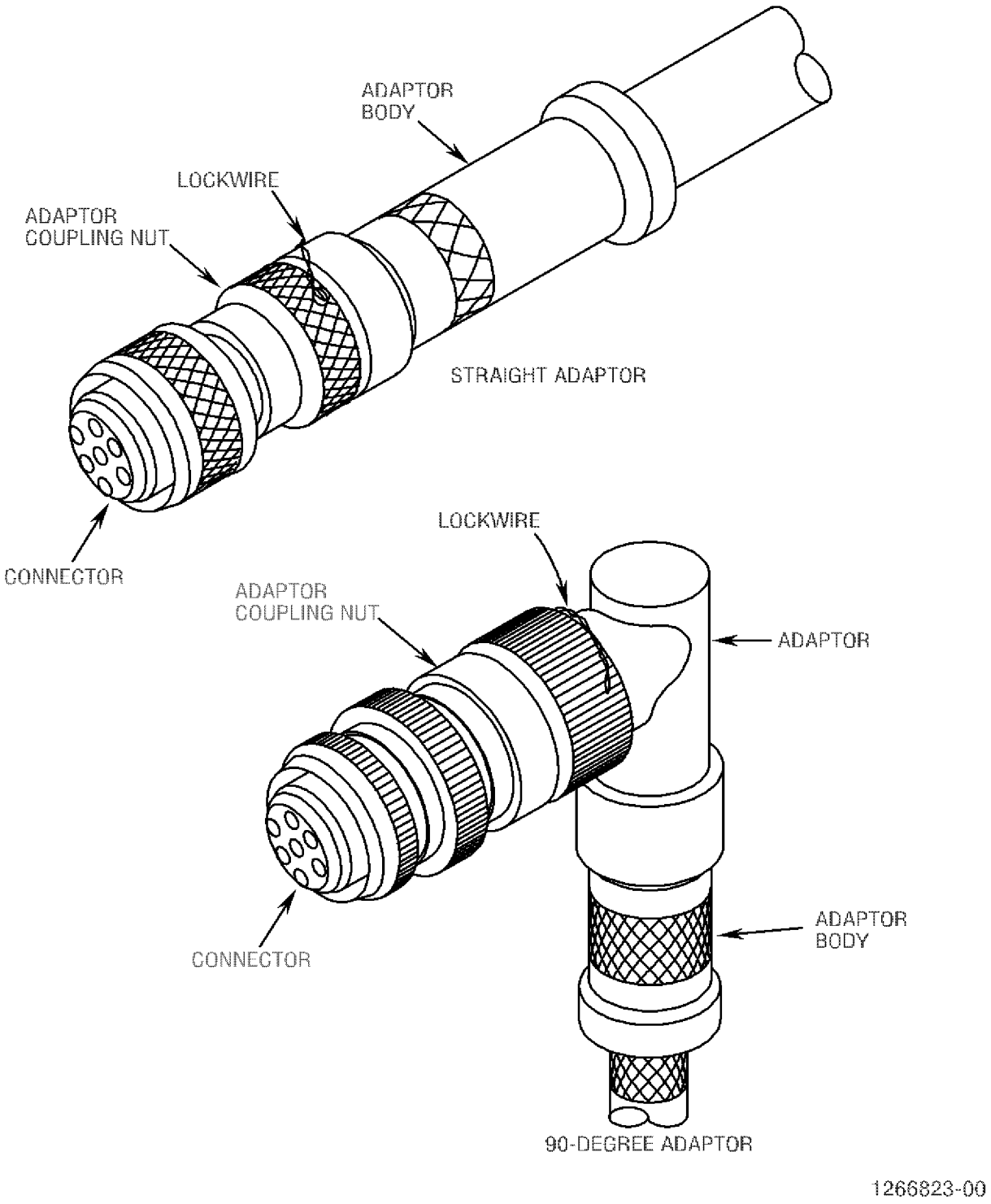


NEVER USE CHANNEL LOCK TYPE PLIERS ON ELECTRICAL CONNECTORS. THE USE OF CHANNEL LOCK STYLE PLIERS WILL CAUSE DAMAGE. ONLY SOFT-JAWED CONNECTOR PLIERS ARE ALLOWED FOR USE ON ELECTRICAL CONNECTORS.


APPLYING TORQUE TO THIS KNURLED RING WILL DAMAGE THE CONNECTOR.
Connector
Receptacle
APPLY TORQUE ONLY TO THIS KNURLED RING.
SOFT-JAW ELECTRICAL PLIERS ARE SPECIALLY DESIGNED TO PREVENT DAMAGE TO ELECTRICAL COMPONENTS.
BM5 70 71 01 0 LCM0 00
1266821-00

Connector Torquing with Soft-Jawed Electrical Pliers
Figure 002

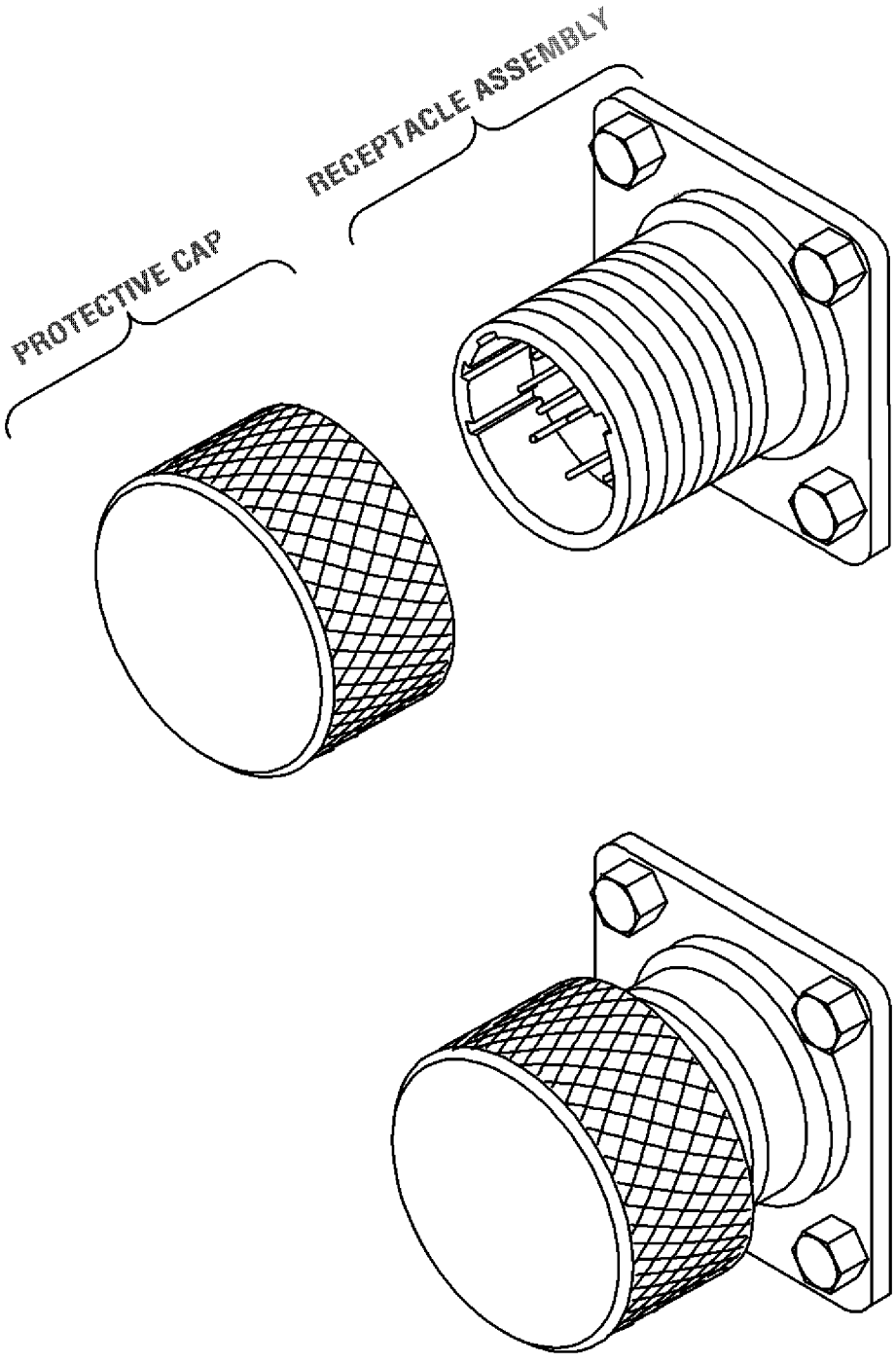
R



BM5 70 71 01 0 LEM0 00

Cable End Plug Connector Assembly
Figure 003

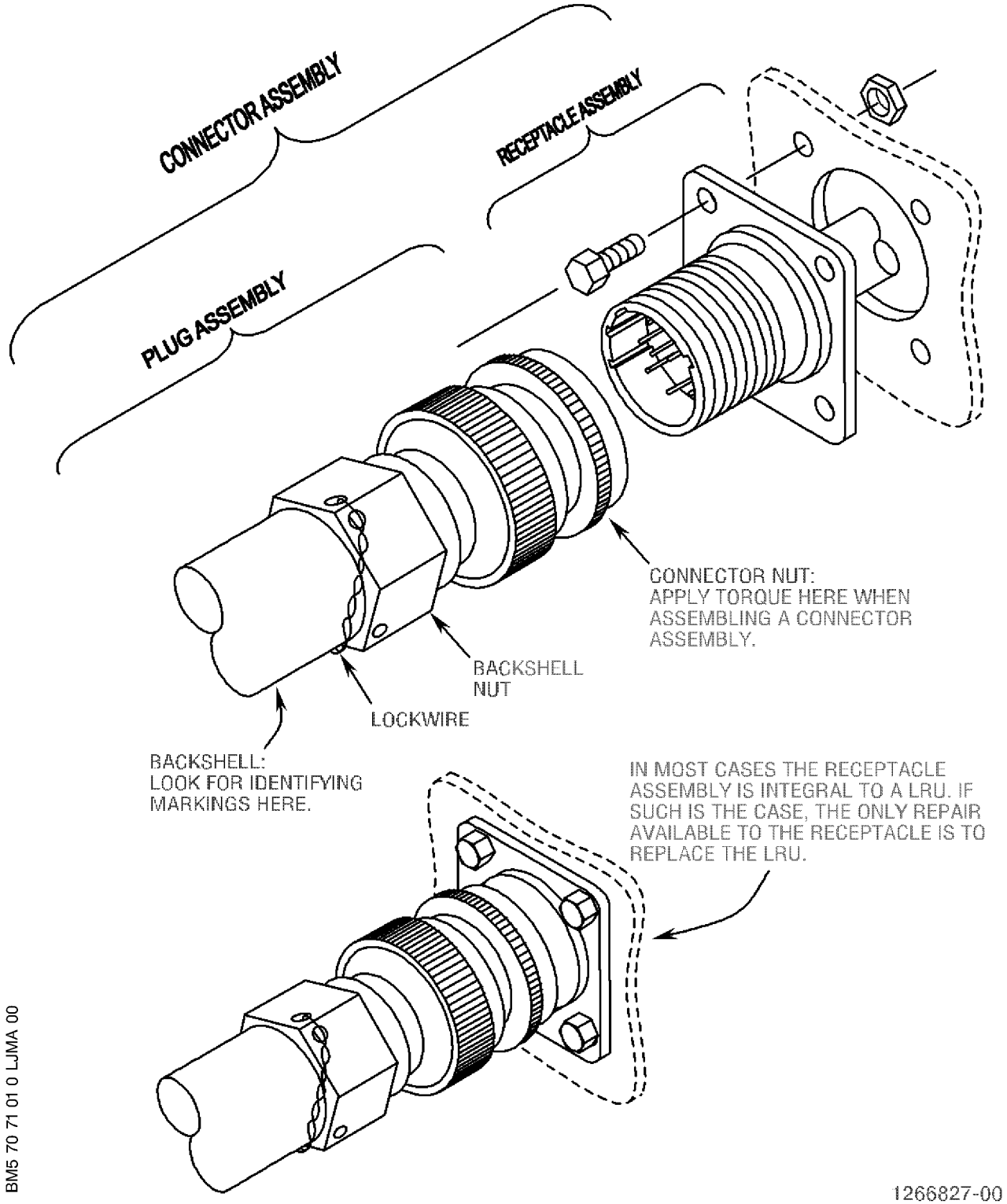
R



BM5 70 71 01 0 LGM0 00

R

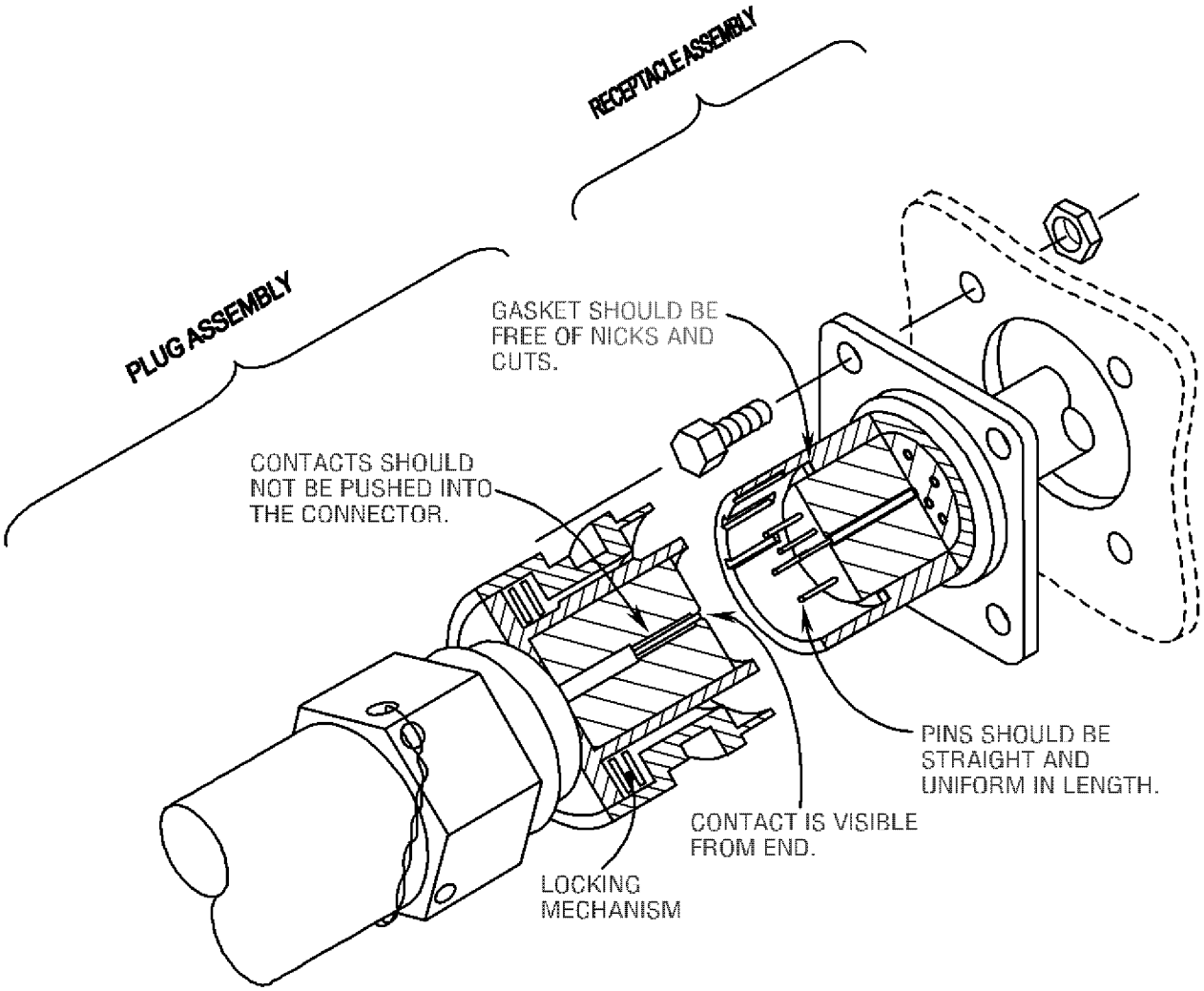
Protective Cap
Figure 004



BM5 70 71 01 0 LJMA 00

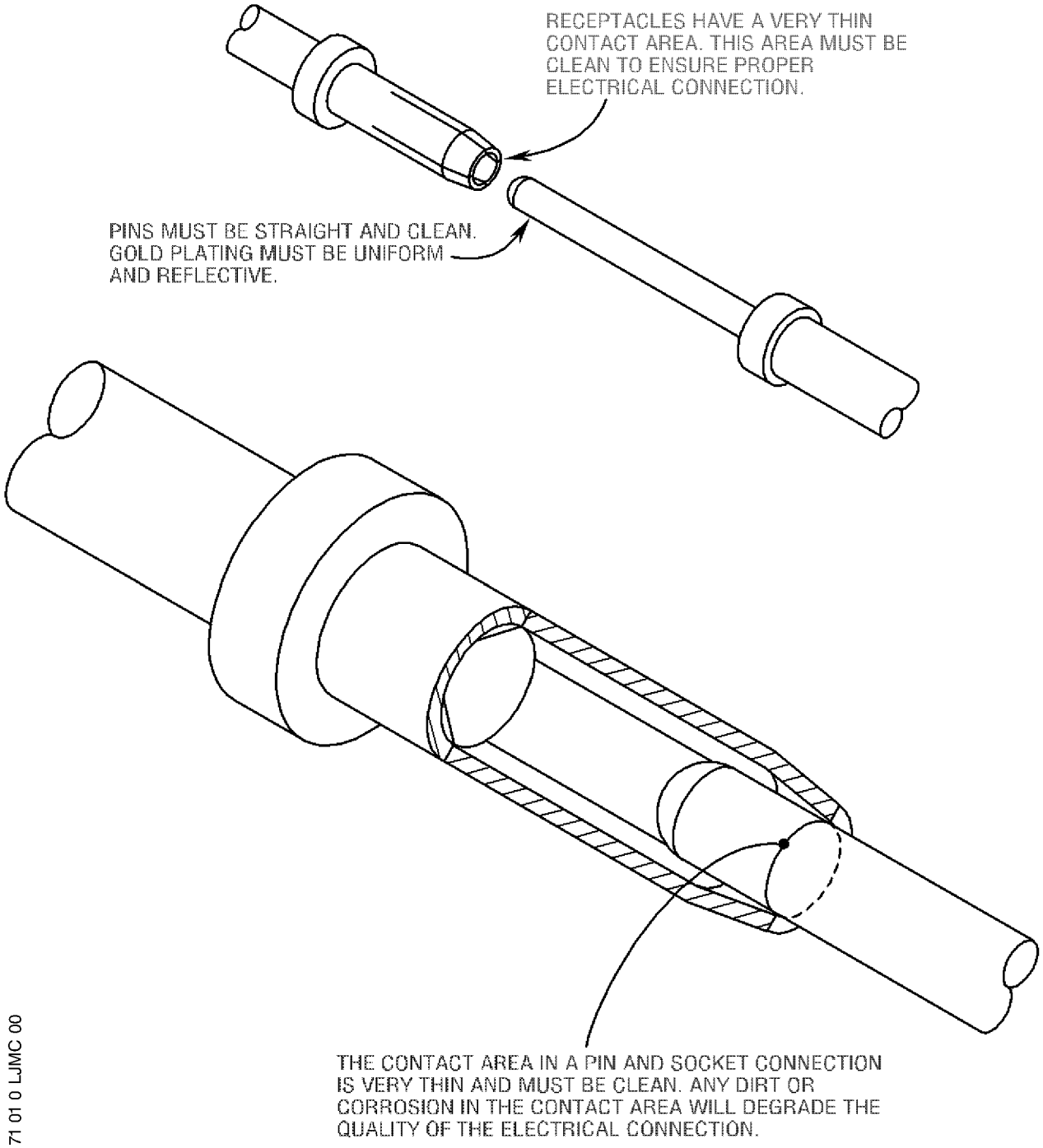
Plug and Receptacle Inspection (Sheet 1/5)
Figure 005

R


RECEPTACLE ASSEMBLY
PLUG ASSEMBLY
GASKET SHOULD BE FREE OF NICKS AND CUTS.
CONTACTS SHOULD NOT BE PUSHED INTO THE CONNECTOR.
PINS SHOULD BE STRAIGHT AND UNIFORM IN LENGTH.
CONTACT IS VISIBLE FROM END.
LOCKING MECHANISM
1266829-00

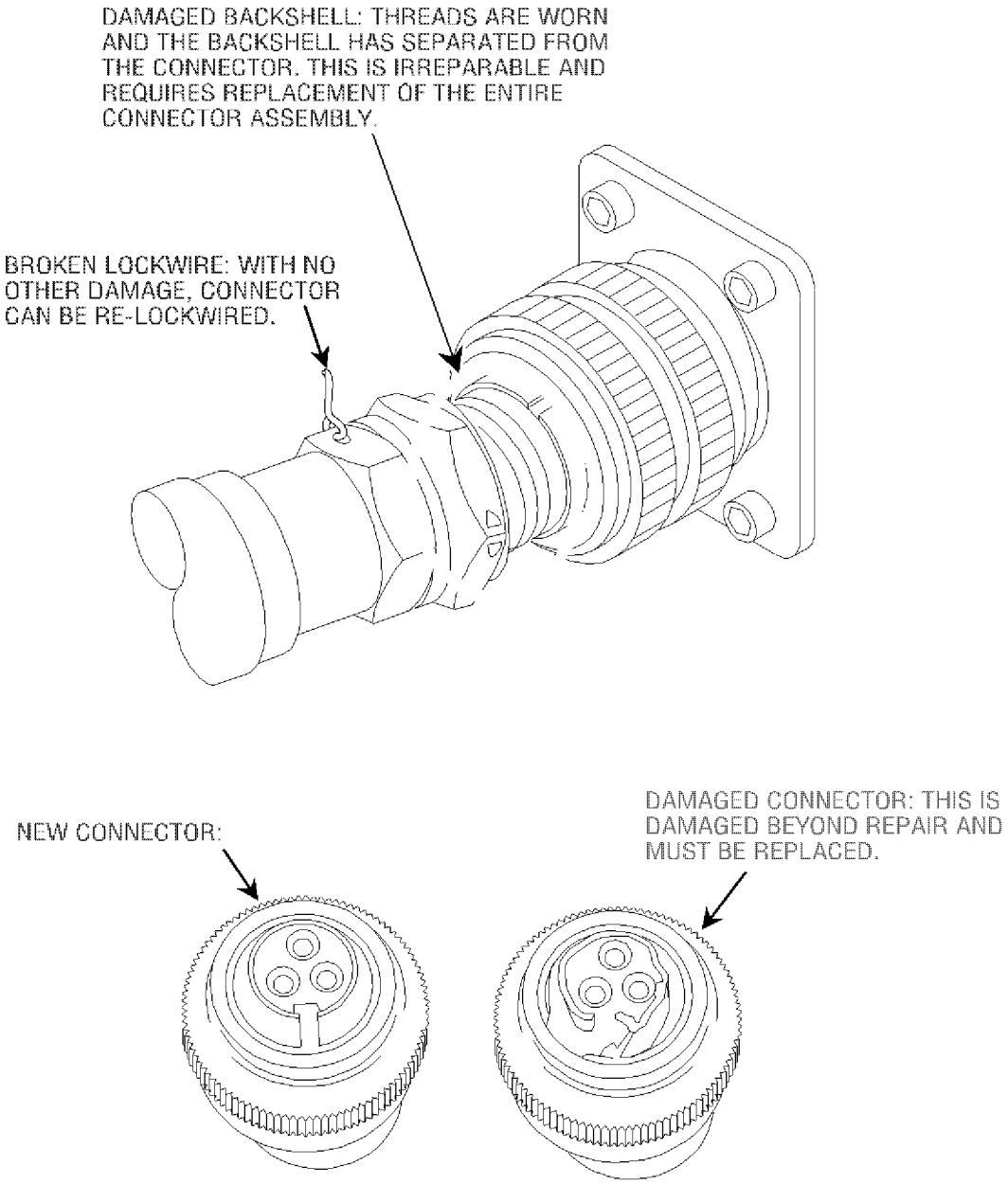
BM5 70 71 01 0 LJMB 00

Plug and Receptacle Inspection (Sheet 2/5)
Figure 005


RECEPTACLES HAVE A VERY THIN CONTACT AREA. THIS AREA MUST BE CLEAN TO ENSURE PROPER ELECTRICAL CONNECTION.
PINS MUST BE STRAIGHT AND CLEAN. GOLD PLATING MUST BE UNIFORM AND REFLECTIVE.
THE CONTACT AREA IN A PIN AND SOCKET CONNECTION IS VERY THIN AND MUST BE CLEAN. ANY DIRT OR CORROSION IN THE CONTACT AREA WILL DEGRADE THE QUALITY OF THE ELECTRICAL CONNECTION.
1266830-00

BM5 70 71 01 0 LJMC 00

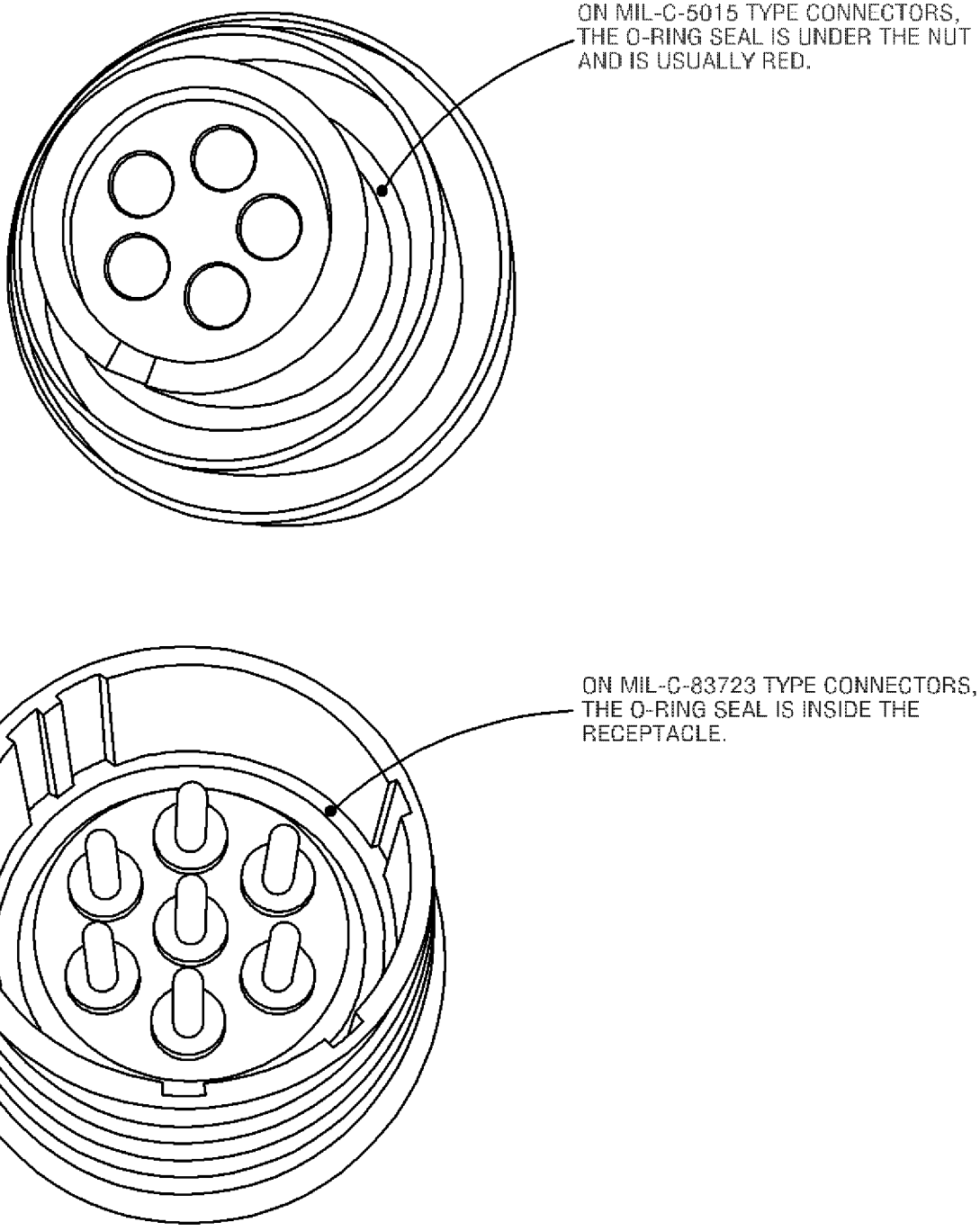
Plug and Receptacle Inspection (Sheet 3/5)
Figure 005


DAMAGED BACKSHELL: THREADS ARE WORN AND THE BACKSHELL HAS SEPARATED FROM THE CONNECTOR. THIS IS IRREPARABLE AND REQUIRES REPLACEMENT OF THE ENTIRE CONNECTOR ASSEMBLY.
BROKEN LOCKWIRE: WITH NO OTHER DAMAGE, CONNECTOR CAN BE RE-LOCKWIRED.
NEW CONNECTOR:
DAMAGED CONNECTOR: THIS IS DAMAGED BEYOND REPAIR AND MUST BE REPLACED.
1266832-00

BM5 70 71 01 0 LJMD 00

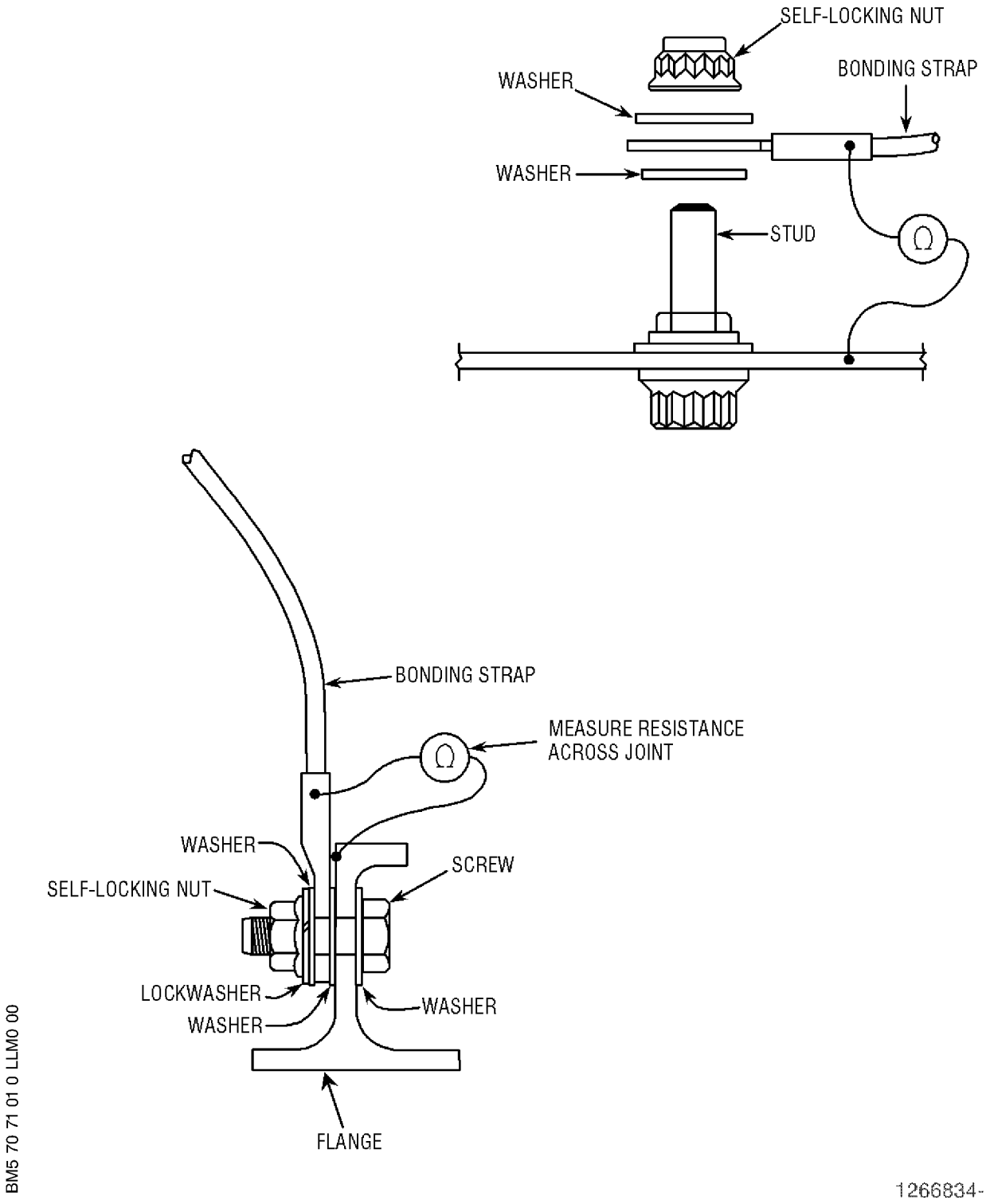
Plug and Receptacle Inspection (Sheet 4/5)
Figure 005

R


ON MIL-C-5015 TYPE CONNECTORS, THE O-RING SEAL IS UNDER THE NUT AND IS USUALLY RED.
ON MIL-C-83723 TYPE CONNECTORS, THE O-RING SEAL IS INSIDE THE RECEPTACLE.
BM5 70 71 01 0 LJME 00
1266833-00

Plug and Receptacle Inspection (Sheet 5/5)
Figure 005

R



Typical Electrical Bonding Configurations
Figure 006

R

SPECIFICATION OF CABLES - DESCRIPTION AND OPERATION

1. Specifications of Cables

R

TYPE CODE/ GAGE	SPECIFICATION	MANUFACTURER REFERENCES	
01/00		RMS 302-00	TENSOLITE PART NUMBER HB2/6011A-1
01/0		RMS 302-0	TENSOLITE PART NUMBER HB1/0612A-1
01/2		RMS 302-2	TENSOLITE PART NUMBER HB02603/A-1
01/4		RMS 302-4	TENSOLITE PART NUMBER HB04611/A-1
01/6		RMS 302-6	TENSOLITE PART NUMBER HB06613/A-1
01/8		RMS 302-8	TENSOLITE PART NUMBER HB08636/A-1
01/10		RMS 302-10	TENSOLITE PART NUMBER HB10691/0179A-1
01/12		RMS 302-12	TENSOLITE PART NUMBER HB12699/9A-1
01/14		RMS 302-14	FILOTEX PART NUMBER 2105-1-14
01/16		RMS 302-16	FILOTEX PART NUMBER 2105-1-16
01/18		RMS 302-18	FILOTEX PART NUMBER 2105-1-18
02/14		RMS 302-2-14	FILOTEX PART NUMBER 2105-2-14
02/16		RMS 302-2-16	FILOTEX PART NUMBER 2105-2-16
02/18		RMS 302-2-18	FILOTEX PART NUMBER 2105-2-18
03/14		RMS 302-3-14	FILOTEX PART NUMBER 2105-3-14
03/16		RMS 302-3-16	FILOTEX PART NUMBER 2105-3-16
03/18		RMS 302-3-18	FILOTEX PART NUMBER 2105-3-18
05/14		RMS 302-1SJ-14	FILOTEX PART NUMBER 1105-1-14
05/16		RMS 302-1SJ-16	FILOTEX PART NUMBER 1105-1-16
05/18		RMS 302-1SJ-18	FILOTEX PART NUMBER 1105-1-18
06/14		RMS 302-2SJ-14	FILOTEX PART NUMBER 1105-2-14
06/16		RMS 302-2SJ-16	FILOTEX PART NUMBER 1105-2-16
06/18		RMS 302-2SJ-18	FILOTEX PART NUMBER

R

TYPE CODE/ GAGE	SPECIFICATION	MANUFACTURER REFERENCES	
			1105-2-18
07/14		RMS 302-3SJ-14	FILOTEX PART NUMBER 1105-3-14
07/16		RMS 302-3SJ-16	FILOTEX PART NUMBER 1105-3-16
07/18		RMS 302-3SJ-18	FILOTEX PART NUMBER 1105-3-18
10/8	MIL-W-25038E	RMS 322-8	BICC PART NUMBER 31-E5-52-705
10/10	MIL-W-25038E	RMS 322-10	BICC PART NUMBER 31-E5-52-704
10/12	MIL-W-25038E	RMS 322-12	BICC PART NUMBER 31-E5-52-703
10/14	MIL-W-25038E	RMS 322-14	BICC PART NUMBER 31-E5-52-702
10/16	MIL-W-25038E	RMS 322-16	BICC PART NUMBER 31-E5-52-701
10/18	MIL-W-25038E	RMS 322-18	BICC PART NUMBER 31-E5-52-700
21/000	MIL-W-22759/3	RMS 324-000	TENSOLITE PART NUMBER 3/0991/80409LA-1
21/0	MIL-W-22759/3	RMS 324-0	TENSOLITE PART NUMBER 1/0991/90105LA-1
30/16		RMS 326-2SJ-16	FILOTEX PART NUMBER 1126-2-16-LS
30/18		RMS 326-2SJ-18	FILOTEX PART NUMBER 1126-2-18-LS
31/16		RMS 326-3SJ-16	FILOTEX PART NUMBER 1126-3-16-LS
34/20		RMS 327-2SJ-20	FILOTEX PART NUMBER 1127-2-20-MS
66/20		RMS 332-2SJ-20	FILOTEX PART NUMBER 1132-2-20-MS
67/20		RMS 332-3SJ-20	FILOTEX PART NUMBER 1132-3-20-MS
70/18			SCC PART NUMBER 254-106603 CH-AL
73/18	M27500-18SM2N23		
74/16	M27500-16SM3N23		
75/20	M27500-20SN1N23		
76/20	M27500-20SN2N23		
77/16	M27500-16SN3N23		
77/20	M27500-20SN3N23		
81/16	MIL-W-22759/8-16		
81/18	MIL-W-22759/8-18		
87/20	M27500-20TA1N6		
88/16	M27500-16TA2N6		
88/18	M27500-18TA2N6		

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TYPE CODE/ GAGE	SPECIFICATION	MANUFACTURER REFERENCES
88/20	M27500-20TA2N6	
89/16	M27500-16TA3N6	
89/18	M27500-18TA3N6	
89/20	M27500-20TA3N6	
104/18		THERMAX PART NUMBER 18-604TF-2NTJ
104/20		THERMAX PART NUMBER 20-604TF-2NTJ
105/20		THERMAX PART NUMBER 20-604TF-3NTJ
107/18		ROCKBESTOS PART NUMBER RSS-5-143-18B

WIRE SPLICE REPAIRS - DESCRIPTION AND OPERATION

1. General

This procedure provides splice repair instructions for the following wire harnesses installed on the powerplants :

Engine	PIPC
CF6-80	71-50-01

Wires or wire bundles which cannot be repaired within the limitations given in this procedure must be replaced.
Wire splice repairs are considered allowable temporary repairs. The defective wire or wires must be replaced the next time the wire harness is removed from the engine.

A. Definition of terms used in this procedure :
(1)Harness - a single bundle or multibranched group of bundles terminated by connectors or terminal lugs.
(2)Bundle - a cable which is terminated by connectors or terminal lugs.
(3)Cable - integral group of unterminated wires.
(4)Wire - a single metallic strand, insulated or uninsulated.

2. Equipment and Materials

Specification	Manufacturer	Code
Crimping Tool, Y14MV	Burndy Corp. Richards Ave. Norwalk, CT 06850	V09922
Splice, YSV16	Burndy Corp. Richards Ave. Norwalk, CT 06850	V09922
Splice, YSV18	Burndy Corp. Richards Ave. Norwalk, CT 06850	V09922
Heat Shrink Tubing WTF1206A-1, 3/8 inch Dia	Penn Tube Plastic Co Clifton Heights, PA	V92009
Tape, Red Silicone Fiberglass RL6000SA	Raybestos Manhattant Industrial Products Anaheim, CA	V94878
Tape, Tying 190L0F21G	Western Filament Corp. Glendale, CA 91204	V00768

3. Wire Harness Repair Limits

A. Splices may not be closer than six inches to a connector backshell.

B. Maximum of one splice per wire is allowed.

C. Maximum of three splices per wire bundle are allowed.

D. Splices may not be located under clamps or in drip loops.

E. Splices must be offset from each other at least 0.12 in., when splicing more than one wire in a bundle.
(Ref. Fig. 001)

F. Splicing of wires in the following critical circuits is prohibited :
(1)Generator power feeders and control circuits.
(2)Fuel condition control motor actuator circuit.
(3)Engine oil quantity indicating system.
(4)Engine fire detection system.
(5)Fuel shutoff valve circuit.
(6)Pressure regulator valve circuit.
(7)Hydraulic pump solenoid circuit.

4. Referenced Procedures
20-25-00 Heat guns for installation of shrink sleeve.

5. Single Wire Unshielded Splice Repair

A. Remove red tape from wire harness to gain access to damaged wire.

B. Cut damaged wire and strip enough insulation to insert wire into splice, with 0.12 in. (3 mm) maximum between end of splice and insulation.
(Ref. Fig. 001)

C. Cut heat-shrink sleeve to extend at least 0.75 in. beyond the end of the wire insulation on both sides of splice. Add 10 percent extra length to compensate for shrinkage.
(Ref. Fig. 002)

D. Slide sleeve over wire.

E. Select the correct size splice for wire size that is to be repaired.
YSV16-16 gage wire
YSV18-18 gage wire.

F. Put one end of the wire into splice and crimp the splice.

G. Pull on wire to make sure that the splice firmly holds the wire.

H. Repeat steps F and G for the other end of the wire.

WARNING : FUEL OR FUEL VAPOR EXPLOSION MAY CAUSE INJURY OR DEATH. DO NOT USE HEAT GUNS WHERE FUEL OR FUEL VAPOR IS PRESENT. HEAT GUNS

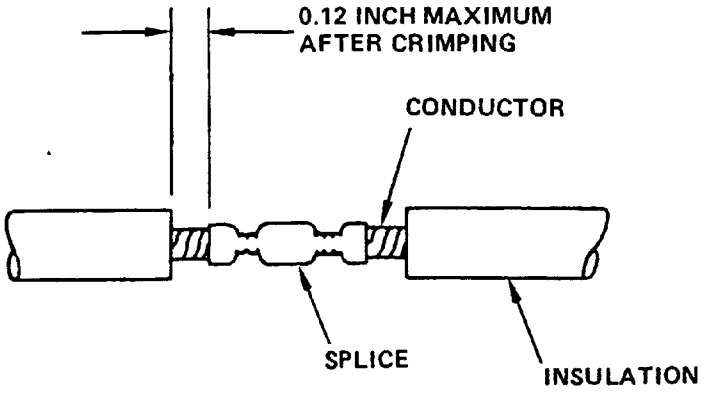
ARE A SOURCE OF COMBUSTION.

WARNING : BREATHING OF FUMES RELEASED FROM WTF HEAT SHRINK SLEEVES DURING THE SHRINKING PROCESS MAY CAUSE INJURY. HEAT SHRINKING OF WTF SLEEVES SHOULD BE DONE UNDER A VENTILATION HOOD OR IN A FORCED AIR DRAFT.

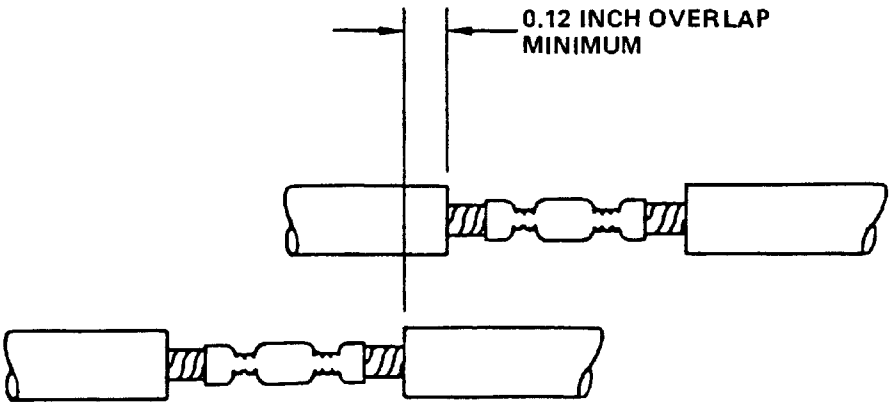
I. Center sleeve over wire splice and shrink into place as follows :
(Ref. Fig. 002)
(1)Attach heat reflector to heat gun. See 20-25-00, heat guns for installation of shrink sleeve.
(2)Shape contour of heat reflector to allow approximately 1 in. between reflector and wire.
(3)Protect all nearly wires and other items that could be damaged by heat with suitable heat shields.
(4)Preheat heat gun for 15 seconds.
(5)Apply heat to sleeve and shrink into place.
(a)Do not exceed 20 seconds heating.
(b)If sleeve is not properly shrunk after 20 seconds, allow wire assembly to cool for at least 5 minutes before applying heat to sleeve again.

J. Wrap harness splice area with red silicone fiberglass tape.
(1)Pull ends of wrap tight and tie with tying tape.
(2)Make sure that the tape wrap extends at least two inches onto the harness on both sides of the splice.
(3)Overlap each tape wrap 50 percent onto the previous wrap.
(4)Wrap harness again in the opposite direction.
(5)Tie each end of wrap with tying tape.

K. Do a functional test of the repaired circuit.



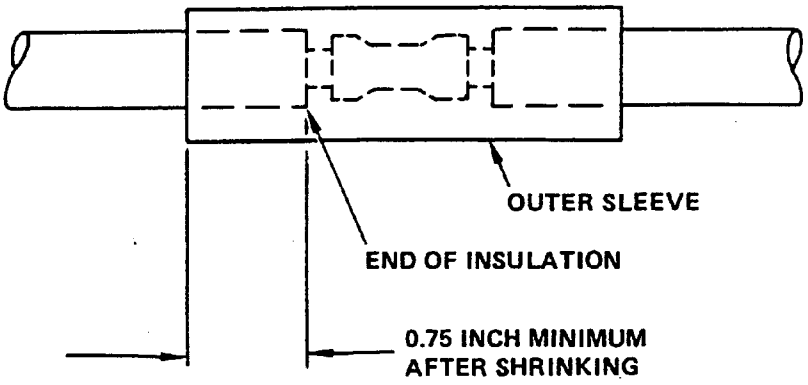
INDIVIDUAL WIRE SPLICE



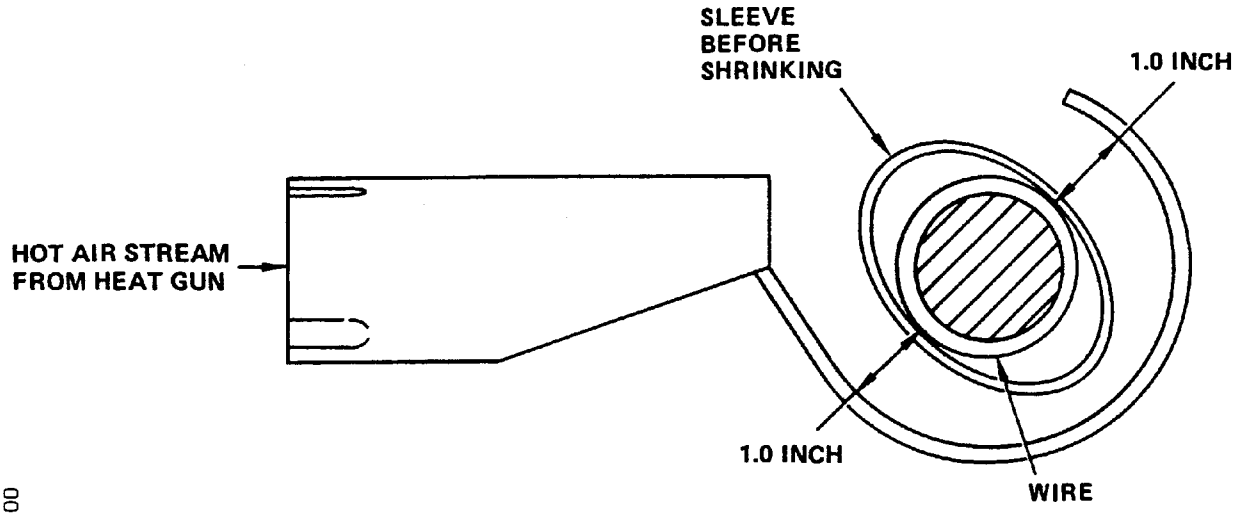
STAGGERED WIRE SPLICES

BM5 70 71 12 0 LAM0 00

Wire Splice Installation
Figure 001



HEAT SHRINK SLEEVE INSTALLATION



HEAT REFLECTOR CONTOUR

BM5 70 71 12 0 LCM0 00

Heat Shrink Sleeve Installation
Figure 002